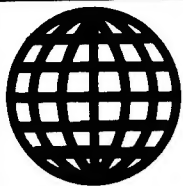


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# **Science & Technology**

***USSR: Electronics &  
Electrical Engineering***

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# Science & Technology

## USSR: Electronics & Electrical Engineering

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Numerical Analysis of Nonsteady Systems With Virtual Cathode [A. D. Poyezd, A. G. Sveshnikov, et al.; VESTNIK MOSKOVSKOGO UNIVERSITETA, SERIYA 3: FIZIKA, ASTRONOMIYA, Vol 30 No 2, Mar-Apr 89]	37
Select Performance Characteristics of a Fiber Ring Interferometer [I. A. Andronova, I. L. Bershteyn; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA, Vol 32 No 4, Apr 89]	37

### New Activities, Miscellaneous

Making Foreign-Language Scientific and Technical Information Available to Specialists in Control Devices and Systems [G. G. Merkulov and G. Ye. Vinokurova; PRIBORY I SISTEMY UPRAVLENIYA, No 4, Apr 89]	39
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**Transition Radiation of Acoustic Waves by Sources Traveling in the Terrestrial Atmosphere**

18600226b Gorkiy IZVESTIYA VYSSHIKH  
UCHEBNYKH ZAVEDENIY: RADIOFIZIKA  
in Russian Vol 32 No 2, Feb 89, pp 145-151

[Article by G. I. Grigorev, N. G. Denisov, O. N. Savina]

[Abstract] This study carries out a detailed investigation of the structure of acoustical-gravitational and surface waves generated in the terrestrial atmosphere over a solid surface by a vertically traveling linear source of mass production. The solution is based on a simple representation of the Green's function obtained in a previous study and in this case applies to the wavefront structure of the volumetric perturbations and the surface waves. In this analysis the general problem is simplified by representing the source of mass production as an infinite filament extended over the y axis and whose motion generates fields independent of y. This allows an exact representation of the Green's function. The study derives formulae that provide a comprehensive description of the structure of the simplest type of perturbation produced by a traveling source of mass production. Equations are also derived for analyzing surface wave perturbations; these formulae are modified versions of those used to analyze standard perturbations. Traditional surface wave analysis techniques are analyzed and compared. This makes it possible to provide a rather complete picture of the volumetric and surface acoustical-gravitational waves occurring in an exponential atmosphere generated by a traveling source of mass production.

**Low-Frequency Acoustical Flow Detection Equipment and Techniques**

18600239a Moscow PRIBORY I SISTEMY  
UPRAVLENIYA in Russian No 5, May 89, pp 5-6

[Article by Yu. V. Lange]

[Abstract] This is a survey review of the primary low-frequency acoustical flow detection techniques as equipment employing such principles. The primary low-frequency acoustical flow detection techniques include

the impedance method, the velosymmetry method, and the free oscillation method. The impedance method utilizes the effect of compound defects between elements in multilayered structures or delamination in laminated plates on the mechanical impedance of the test object. The Soviet impedance-type flow detectors include the IAD-3 and the AD-40I flow detectors while the British models employing the impedance method include the AFD-2, MIA3000 and MIA2500. The free oscillation technique is based on the excitation of self-damped elastic oscillations in the test object or a portion of the object and analyzing the parameters of such oscillations. This technique has been called the "spectral", "impact" and "vibroacoustic" technique in earlier publications. This article also analyzes the local free oscillation technique which is most extensively utilized in the USSR. Finally the article discusses future developments in flow detection including the use of analog-digital processing of information where spectral analysis will be performed by high-speed analog devices while digital devices will be used for subsequent processing and display of the results.

**Ultrasonic Flow Detectors**

18600239b Moscow PRIBORY I SISTEMY  
UPRAVLENIYA in Russian No 5, May 89, pp 6-8)

[Article by V. V. Aristov, Yu. M. Shkarlet]

[Abstract] This article is devoted to a survey of ultrasonic flow detectors. The analysis examines the design principles, function, and specifications of the UI-70, UI-15R and the UI-25ETs flow detection systems. The UI-70 ultrasonic flow detector is used for manual and automated flow detection for a variety of metallic and plastic products with information output on an oscilloscope in A and B sweeps in real time. The UI-15R is an experimental prototype microprocessor controlled flow detector. The UI-25ETs unit is a manually- controlled echo tomography system. The image is generated in a digital memory block of 256 by 256 four-bit words and is reproduced on a monochrome television screen. The stored image can be used to measure the distance between two random points or to magnify image scale. The specification for these acoustical flow detectors are provided.



UDC 621.397.132.129:535.65

**Problems of Colorimetry in New Television Systems***18600206a Moscow TEKHNICA KINO I TELEVIDENIYA, in Russian No 4, Apr 89 pp 14-18*

[Article by S. V. Novakovskiy, A. V. Kotelnikov, and Nidal Fallukh, Moscow Institute of Communications]

[Abstract] Selection of the primary colors for high-definition television receivers and of the axes for chrominance signals is examined, considering that the two axes should correspond to the directions of maximum and minimum spatial color resolution of the eye and that one of them should pass through the regions of the color triangle where the eye is most sensitive to change of color tone. The pair of wideband and narrow-band axes in the NTSC system is compared with the pair of R-Y and B-Y axes in both SECAM and PAL systems. The coordinates of the three primary "luminophor" colors in the existing YeS (USSR), FCC (U.S.), and NHK (Japan) systems are identified on the chromaticity diagram, retention of present standards in future television systems such as those with a laser telekinescope requiring correction of colors, a broader color triangle, and new selection of coding axes. Figures 7; references 17: 2 Russian, 15 Western.

UDC 621.397.743:681.7.068

**Use of Analog Pulse Modulation Methods in Fiber-Optic Cable Television***18600206b Moscow TEKHNICA KINO I TELEVIDENIYA in Russian No 4, Apr 89 pp 18-22*

[Article by V. I. Kirillov, V. V. Serikov, and A. A. Tarchenko, Minsk Institute of Radio Engineering]

[Abstract] Design of fiber-optic cable television systems with analog pulse modulation of signals is considered, the interference immunity of analog modulation being over the relatively short distances practically as high as that of digital modulation while analog pulse modulators and demodulators are much simpler and more economical than analog-to-digital and digital-to-analog converters. The characteristics of home distribution networks, including the type of directional system, are taken into account in a comparative evaluation of pulse-frequency modulation, pulse-width modulation, and pulse-phase modulation. Hybrid cable television systems with frequency division of channels and with space or time division of channels are considered, also interactive ones with a tree structure of the home distribution network. Figures 4; references 11: 7 Russian, 4 Western.

UDC 534.6:534.843.242

**Measurement of Reverberation Time in Television and Radio Broadcasting Studios***18600206c Moscow TEKHNICA KINO I TELEVIDENIYA in Russian No 4, Apr 89 pp 23-24*

[Article by M. Yu. Lane and N. S. Nesterenko, All-Union Scientific Research Institute of Television and Radio Broadcasting]

[Abstract] Measurements of the reverberation time in television and radio broadcasting studios were made, for a determination of the number of readings of the reverberation drop from -5 dB to -35 dB (sound energy level) needed for averaging so as to ensure the necessary accuracy. Measurements were made with a Bruel & Kjaer 4418 sound analyzer for structural acoustics, a test signal with a one-third octave bandwidth being generated and the echo signal being received by the microphone. The measurement error, owing to randomness of the signal but also depending on the reverberation characteristics of the room, was estimated on the basis of calibration against a digital delay line operating as a comb filter and simulating a room where a high density of echo signals ensured a strongly exponential signal decay over a dynamic range of 50 dB. Measurements were subsequently made in various parts of studios with a dynamic range not less than 60 dB and a linear drop of sound pressure. The results indicate a normal distribution of readings with a dispersion almost independent of the microphone location. The number of necessary readings was found to vary from 3 to 9 depending on the frequency band as well as on the studio category: I (speech, sound recording, audition), II (radio broadcasting of literary programs, floor area smaller than 350 m<sup>2</sup>), III (floor area 350 m<sup>2</sup> or larger). Figures 1; tables 2; references 7: Russian (1 ISO).

UDC 621.397.7

**Distribution of Low-Content Lines in Television Frame***18600206d Moscow TEKHNICA KINO I TELEVIDENIYA in Russian No 4, Apr 89 pp 25-26*

[Article by I. R. Mamedov, Azerbaijan Polytechnic Institute imeni Ch. Ildrym]

[Abstract] Considering that in a television frame the lines with a constant luminance signal and thus low information content need to be multiplexed for transmission of additional information, the number of such lines was counted in many frames for a determination of its statistics. The probability density according to the histogram is now calculated by the method of orthogonal expansion into a Gramm-Charlier B series with the Poisson distribution as reference function. Accuracy of the resulting theoretical distribution is established by reconciling the latter with the ch-square distribution, considering that the sum of all frequencies must be equal

to 1 and that the mathematical expectations as well as the dispersions of both distributions must be respectively the same. The low-content lines are found to appear as "bundles" and, with the distribution of their number known to approach the Poisson distribution with  $\lambda$  equal 18, it becomes possible to calculate the probability density of additional information being transmitted during a cycle of given length. References 4: 3 Russian, 1 Western (in Russian translation).

### The International Committee for Testing High Definition Television Standards

18600251a Moscow *TEKHNICA KINO I TELEVIDENIYA* in Russian No 6, Jun 89, pp 63-66

[Article by V. Makartsev, L. Chirkov, L. Ioffe]

[Abstract] This article is an interview with H. Tanimura of the Sony Corporation conducted during the International Committee on Testing of High Definition Television Standards held in Moscow in September 1988. The Sony Corporation delivered a high definition television system to Moscow for testing in late February of 1989. Tests on this system began in mid-March 1989. Mr. Tanimura discusses Sony's early involvement in studio equipment for high definition television. He emphasizes that Sony has not dealt with high definition transmission procedures or practices. Mr. Tanimura also claims that Japan will be first to develop a unified standard for high definition television in view of the fact that the United States has not agreed upon a single standard for this format. Other topics include high definition filming methods, Sony studio cameras and tape equipment as well as the commercial reputation of Sony as a manufacturing company with customers.

### The Sony High Definition Television System

18600251b Moscow *TEKHNICA KINO I TELEVIDENIYA* in Russian No 6, Jun 89, pp 66-70

[Article by A. Ya. Khesin]

[Abstract] This article discusses the new Sony high definition television system which is an improved modification on their previous system developed and reported in 1985. The new system includes a more advanced television camera, three types of scanners, and an extensive selection of fixed focal length lenses and variable lenses together with video signal processors and camera control systems, digital video tape recorders and a video disk playback unit together with a 1125/60 to NTSC standard converter. In addition to the component configurations and specifications of the individual components, this article also reports possible systems configurations of the overall high definition television system including studio layout, audio tape recorder feed and floor configurations. Model numbers and specifications are provided on the majority of the studio equipment.

### Satellite Communications Systems: System Parameters

18600252a Moscow *RADIO in Russian* No 6, Jun 89, pp 6-8

[Article by A. Varbanskiy]

[Abstract] This article is a journal overview of the design principles and operational practice of satellite communications systems. The article focuses on the specific aspects of satellite communications systems that differentiate such networks from standard HF and VHF radio communications. The article discusses such areas as geostationary spacecraft, ground trace points, standard satellite radiation power levels, satellite orbital parameters, uplink and downlink frequency allocations for various communications services, and standards and regulations on satellite radio communications systems.

### Microelectronics Under Microscope

18600245a Moscow *RADIO in Russian* No 5, May 89, pp 9-11

[Article by Ya. Fedotov, doctor of technical sciences, professor]

[Abstract] A comprehensive overview of trends in microelectronics worldwide reveals their tremendous impact on computers, automation, robotics, communications, appliances, and medical equipment. Developments which have contributed most significantly to the rapidly rising degree of integration of digital circuits from large-scale into the very-large-scale range include use of host matrix chips and semi-custom circuits, computer-aided design techniques, application of molecular electronics involving molecules, especially organic ones, with two or more stable states and leading to such devices as liquid crystal displays, also appropriate combination of molecular-beam epitaxy and organometallic thin-film technology with electron-beam lithography and "dry" plasma etching. The impact of microelectronics and circuit integration is best illustrated by projections of computer speed covering mainframe computers, minicomputers, personal computers, and microcomputers from the 1961-74 period to the year 1995. Figures 1; references 3: Russian.

### Television Broadcasting Via Satellite

18600245b Moscow *RADIO in Russian* No 5, May 89, pp 12-15

[Article by A. Barbanskiy, first deputy chief, Central Administration of Space and Radio Communication, USSR Ministry of Communications]

[Abstract] A brief review of basic principles of communication via a geostationary satellite is followed by mention of USSR satellites for television broadcasting,

"Raduga" having been the first one launched in 1975 and subsequent ones of the "Gorizont" type operating since 1980. All satellite television broadcasting systems now in existence worldwide are classified into fixed ones including 4 GHz or 11GHz TV Reception Only and also radio broadcasting ones. The latter include the USSR 740 MHz "Ekran" and 12 GHz STV-12, the 12 GHz West German TVSAT and French TDF, and the 2.6 GHz Indian educational one. Most promising for satellite radio broadcasting appears to be the 12 GHz channel. Noteworthy is the current development of Direct Television Broadcasting without ground relay stations, fraught with technical and legal problems resolvable on the international level only.

#### **Video Cassette Recorder 'Elektronika VM-12'**

*18600245d Moscow RADIO in Russian No 5, May 89  
pp 58-62*

[Article by V. Chaplygin, Voronezh]

[Abstract] In this eighth article on the Elektronika VM-12 video cassette recorder is described its chrominance channel, the recorder also having a black-and-white channel. Chrominance signals can be encoded either in SECAM or in PAL for processing in this recorder. The channel structure and the functions of its components are outlined in terms of the PAL system, considering that SECAM is simpler and therefore requires less explanation. Continuation is to follow. Figures 7.

### **Detection of an Extended Radio Source With an Unknown Radiance Distribution**

18600226a Gorkiy IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOFIZIKA  
in Russian Vol 32 No 2, Feb 89, pp.138-144

[Article by V. I. Kostylev]

[Abstract] This study employs a generalized maximum likelihood method to synthesize a detection algorithm for detecting a random radio emission source with an unknown spatial radiance distribution. This algorithm does not require a priori knowledge of the radiance distribution over the radiating surface. The properties of detecting a source based on this parameter are investigated. The algorithm is a modification of a previously-derived extended radio source detection algorithm that is invariant to the spatial radiance distribution. This algorithm employs a statistical estimate of this distribution and the appropriate formulae are provided. The study also reports results from a numerical computer simulation in cases where the function of the algorithm cannot be determined analytically. The calculations reveal that the detection performance using the proposed algorithm improves as the threshold level increases from 0 to 3.5 and remains virtually unchanged with a further increase in the threshold level to 4. The analysis also suggests that the performance of the algorithm is inferior to the previously proposed algorithm since the former employs auxiliary information on the true radiance distribution of the detected radio emission source.

### **Performance Analysis of an Adaptive Antenna Array With a Randomly Moving Aperture in Correlated Interference Conditions**

18600226c Gorkiy IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOFIZIKA  
in Russian Vol 32 No 2, Feb 89, pp.193-198

[Article by A. A. Maltsev, I. V. Savinov, G. V. Serebryakov]

[Abstract] This study considers the effect of the correlation between interfering and legitimate signals on the performance of a bounded adaptive antenna array. The analysis carried out in this study suggests that the correlation serves to suppress the legitimate signal at the output of the system. A modified adaptive array is proposed to eliminate this effect; this design involves introducing random lateral motion of the antenna so that the aperture line remains parallel. The additional phase shifts caused by the position fluctuations will be different at each time for each signal since the signals arrive from different directions. In order to test the design the performance of a linear four-element bounded equidistant adaptive antenna array is simulated for the case where a legitimate quasisinusoidal signal is incident along the normal to the array and interference at the same frequency arrives at a 30° angle. Directions are given for different random motion levels; the relations provided in the study clearly indicate that the directivity in the direction of the interference diminishes with increasing

random motion. The output power in this case is largely determined by legitimate signal power and is consistent with the calculated value.

### **Radar Sounding of Small-Scale Artificial Ionospheric Turbulence**

18600226d Gorkiy IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOFIZIKA  
in Russian Vol 32 No 2, Feb 89, pp.251-252

[Article by V. B. Avdeev, L. M. Erukhimov, S. A. Metelev, A. V. Rakhlin, A. P. Yarygin]

[Abstract] This article reports radar sounding tests to measure small-scale artificial ionospheric turbulence carried out in 1986. The analysis focuses on small-scale artificial turbulence produced in the F-layer by short-wave radiation from a "Sura" unit. The coherent radar probing at 170 MHz was located 900 km to the south of the Sura unit in the signal backscatter range. The study reports that backscattered radar signals from the small-scale artificial ionospheric turbulence were observed on the 360° radar indicator and the ranger display in all heating cycles when small-scale artificial ionospheric turbulence was generated at the calculated image surface over the Sura heating unit. The high range resolution of this configuration made it possible to detect signals scattered by various areas within the scattering region, which revealed isolated and separate scattering centers. The overall performance analysis suggests that radar sounding proves to be an effective technique for investigating the scattering properties of small-scale artificially-induced ionospheric turbulence and can be used to determine its complex spatiotemporal structure.

### **The Effective Height of a Low-Frequency Vertical Electrical Antenna**

18600226E Gorkiy IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOFIZIKA  
in Russian Vol 32 No 2, Feb 89, pp.253-255

[Article by I. G. Kudintseva, A. P. Nikolaenko]

[Abstract] This study analyzes the effect of the conductivity of support structure and the degree to which this alters the effective height of an antenna compared to its geometric height. The study also derives formulae describing the effective height of an antenna with a lumped capacitance of the metallic support structure. This analysis is based on a model where the support mast is represented as one half of an ideally conductive ellipsoid with a semimajor axis perpendicular to the plane of an ideally-conducting terrestrial surface whose potential is equal to zero. The field sensor is located at point a over the major axis of the ellipsoid. The analysis reveals that the mast serves to reduce the effective height of the antenna compared to the height of the field sensor, and also suggests that all other conditions remaining equal, extending the support mast of the antenna will serve to increase the effective height.

### Effect of Turbulence Parameter Fluctuation on Wave Attenuation in a Tropospheric Waveguide

18600226f Gorkiy IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOFIZIKA  
in Russian Vol 32 No 2, Feb 89, pp 255-256

[Article by V. K. Ivanov, V. N. Lanovoy, V. D. Freylikher]

[Abstract] This study proposes a theoretical approach for analyzing fluctuations in the turbulence parameters of the troposphere on wave attenuation in a tropospheric waveguide. In order to test the effectiveness of this approach, field measurements were carried out to measure the distance relation of the field of a forward signal propagating in a bounded atmospheric layer over the oceanic surface combined with simultaneous measurement of the spatial distribution of the refractive index. Two ships were used to conduct the experiment with the transmitter installed on one ship and the receiver installed on the other. The refractive index of the oceanic atmospheric surface layer was measured by means of refractometers whose primary measurement element was an open cavity resonator with an eigenfrequency that was a known function of the measured quantity (the refractive index). This set of instruments made it possible to carry out simultaneous measurements at either four fixed points vertically through the atmosphere or at two points, one of which varies along the vertical. The time plots and the wind and ship speed data recorded by these instruments were used to determine both the regular (averaged over 30 min) altitude profiles of the refractive index as well as the fluctuation characteristics of atmospheric turbulence at various altitudes, including structural functions, coherence functions, etc. The study reports the attenuation decrements for the case where fluctuations are excluded and included and are compared to a computer calculation. The data provided in this study suggest that variability of the turbulence parameters serves to reduce the linear attenuation decrement. A comparison of calculation data also suggests that when fluctuations of the structural constant are taken into account it is possible to explain on a quantitative level the observed range of dependences of the attenuation function of VHF signals in an oceanic tropospheric waveguide.

UDC 538.574.6

### Complex Extrinsic Waves in Long-Distance Radio Communication Problem: Part 2

18600228a Gorkiy IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOFIZIKA  
in Russian Vol 32 No 3, Mar 89 (manuscript received  
20 May 87) pp 276-281

[Article by V. N. Mirolyubov, Irkutsk State University]

[Abstract] An explicit analytical expression is derived for complex extrinsic radio waves propagating by the diffraction mechanism through a dielectric ionosphere. Numerical estimates for such waves propagating through the E-layer indicate that only one such wave or two of them contribute to the diffraction component of the wave field at a receiver

on earth, scattering of waves disregarded and the propagation process assumed to be adiabatic. A comparison of theoretical results with experimental data, the original model of the permittivity profile having been modified so as to account for sphericity and stratification of the ionosphere, indicates that diffraction along horizontally homogeneous or nearly homogeneous channels is significant independently of scattering. Single scattering of complex extrinsic waves along the ionospheric EF-layer is analyzed next, assuming that the fluctuation component of its permittivity represents a quasi-uniform random field with zero mean value and a certain correlation radius. Numerical estimates made in the Born approximation confirm earlier conclusions that the mean scattering intensity depends on the radius of the reflection zone, but experimental verification is still needed. The author thanks V. M. Polyakov and M. V. Tinin for attentiveness and fruitful discussions, A. I. Agaryshev for helpful suggestions and consultations, and S. M. Mikheyev for assisting with numerical computations. Figures 2; references 25: 18 Russian, 7 Western.

UDC 621.315.592

### Peculiarities of Amplification of Electromagnetic Signals in Quantum Superlattices With High Miniband-to-Miniband Tunneling Current

18600228b Gorkiy IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOFIZIKA  
in Russian Vol 32 No 3, Mar 89 (manuscript received  
27 Apr 87) pp 282-288

[Article by L. K. Orlov and Yu. A. Romanov, Scientific Research Institute of Engineering Physics at Gorkiy State University]

[Abstract] Amplification of electromagnetic signals in semiconductor quantum superlattices is analyzed for the feasibility of raising the upper frequency limit, inasmuch as the high-frequency characteristic of such structures depends on the tunnel current through barriers between minibands as well as on the constant component of the external electric field. A one-dimensional quantum superlattice is considered and the response of its electronic subsystem to a uniform electric field is calculated, with a dispersion law in the strong-coupling approximation, assuming an electric field with a large constant component  $E_0$  and a small purely cosinusoidal one whose frequency is equal to  $eE_0d/h$  ( $e$ —electron charge,  $d$ —period of superlattice,  $h$ —Planck constant) minus the reciprocal of the quasi-pulse relaxation time. The instability regions for high-frequency oscillations are determined next, additional instability regions appearing beside the principal one owing to a strong split of absorption resonance peaks and an increasing dominance of amplification as the intensity of the electric field is raised and the tunnel current increases. It accordingly becomes possible to widen the frequency range of amplification upward by operating the quantum superlattice device within ranges of its current-voltage characteristic where its differential static conductivity is



positive and the differential dynamic one is negative. Figures 5; references 10: 7 Russian, 3 Western.

UDC 537.874.6

### **New Phenomena Based on Theory of Open Periodic Guide Structures**

18600228c Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 32 No 3, Mar 89 (manuscript received 16 Mar 87) pp 331-338

[Article by Yu. K. Sirenko, Institute of Radiophysics and Electronics, UkSSR Academy of Sciences]

[Abstract] Intrinsic waves in a metal strip with a single-row periodic array of holes are associated with the nontrivial solution to the not self-adjoint spectral problem with conventional boundary conditions for the electromagnetic field at the edge surfaces of the holes. The spectrum of intrinsic waves in such an open guide structure is qualitatively analyzed and related to their propagation constants on the infinitely-sheeted Riemann surface, three direct corollaries and one proposition being inferred from Green's second identity and the apparent-power theorem. Particularly interesting physical consequences are two phenomena, namely intertype coupling of intrinsic waves with anomalous changes of the free-oscillation Q-factor and existence of regular intrinsic waves with real wave numbers in such structures. Figures 6; references 13: 12 Russian, 1 Western (in Russian translation).

### **Measurement of Backscattering Characteristics of Sea Ice**

18600226a Gorkiy IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 32 No 4, Apr 89, pp 395-399

[Article by A. Ye. Machulko, G. S. Mizezhnikov, V. B. Nekrashevich, A. G. Selskiy, V. B. Shteynshleyger, A. V. Yanovich]

[Abstract] This study carries out measurements of the effective scattering area of sea ice by means of a specially-designed 20 and 20 cm wavelength band radar instrument on board the "Sibir" (Siberia) nuclear-powered ice breaker during its voyage in the Barents and Black Seas. A single parabolic antenna 1 m in diameter with separate radiators for each frequency band is used to both transmit and receive the signals in the 10 and 20 cm bands. A standard G4121 test generator was used as the transmitter; this unit produces .07-.1 mcs pulses at a peak power of 300 mW and a repetition rate of  $10^5$  Hz. The antenna was installed 23 m above the sea surface on the port side of the ice breaker. The beam scanned perpendicular to the ice breaker route in elevational tilt in two second periods over a 5 to 70° range relative to the vertical. This made it possible to scan a sea strip approximately 50 m wide on one side of the ice breaker for its entire route. An analysis of the data recovered from this experiment suggested the following conclusions: at the 20 cm wavelength range the effective scattering area for ice

rim diminishes compared to the effective scattering area of the sea surface and bottoms out at an ice thickness of 15 to 25 cm. The effective scattering area of the ice begins to grow with increasing ice thickness and at approximately 1 m it is nearly identical to that of the sea surface. The effective scattering area of hummocky ice is 6 to 8 dB higher than that of the sea surface for angles of incidence exceeding 20°. The lowest effective scattering area in these experiments was observed for smooth, thick ice such as landfast ice.

### **Application of the Schwinger Variational Method to the Scattering of Electromagnetic Waves by Inhomogeneous Layers With Rough Surfaces**

18600226c Gorkiy IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 32 No 4, Apr 89, pp 461-467

[Article by F. G. Bass, A. I. Timchenko]

[Abstract] This study is devoted to the application of the Schwinger variational principle to the problem of scattering of electromagnetic waves by a layer with bulk permittivity fluctuations for the case where the layer is bounded by rough surfaces. The first section of this study develops a functional for the scattered radiation intensity and proves its fundamental properties. The Schwinger principle is then used as the basis for formulating a variational iterative method of solving the integral equation. The second section contains results from the solution of the integral equations of transport theory obtained for the case where expressions evaluated by iteration are used as the test functions. The study employs backscattering off a layer formed by snow cover on a rough, underlying surface as an example. The analysis reveals that a variational functional can be used to solve the problem of electromagnetic wave scattering in an absorption layer with bulk permittivity fluctuations and irregular surfaces. This functional is analogous to the functional proposed by Schwinger for the diffraction problem. The study also suggests that by appropriate selection of the comparison functions this method yields sufficient accuracy of the solution and can be used to adequately describe experimental data.

UDC 621.391.81:621.371.029.65

### **Attenuation of UHF Radio Waves Along Communication Lines Through Dense Atmospheric Sand-dust Aerosol**

18600240a Moscow RADIOTEKHNIKA in Russian No 5, May 89 (manuscript received, after completion, 26 Aug 88) pp 3-5

[Article by T.I. Arsenyan]

[Abstract] Propagation of UHF radio waves through an atmosphere heavily loaded with desert sand or volcanic dust is considered and the attenuation coefficient calculated in the Rayleigh approximation, assuming a monodisperse medium, is shown to represent only the theoretical lower bound. Correction based on experimental data covering S-band to Q-band radio waves and media



with a dielectric constant ranging from 2.5 to 10.65 revises the theoretical estimate upwards and indicates that the attenuation can be sufficiently strong to disrupt communication. Figures 1; tables 1; references 8: 2 Russian, 6 Western.

UDC 691.391.812.62

#### **Parametric Estimate of Communication Reliability in Tropospheric Radio Channel**

*18600240c Moscow RADIOTEKHNIKA in Russian No 5, May 89 (manuscript received, after completion, 19 Sep 88) pp 11-12*

[Article by V.G. Grigoryev]

[Abstract] The statistical error of estimates of communication reliability in a tropospheric radio channel based on measurement by the parametric method of moments is calculated, assuming a log-normal distribution of slow signal fadeouts in such a channel and a simple harmonic variation of its two parameters  $m(t)$  and  $\sigma(t)$  over a diurnal period. The dependence of the error on the sample size is established with the aid of an Edgewood series expansion of the one-dimensional fadeout distribution function at the signal detection threshold. A comparison with estimates based on nonparametric measurements indicates that almost only half the sample size and thus half the time is needed for attainment of the same accuracy with the parametric method. Figures 1; references 6: Russian.

UDC 621.396.67

#### **Four-Element Space Filter for Suppression of Multiple-Beam Interference**

*18600240d Moscow RADIOTEKHNIKA in Russian No 5, May 89 (manuscript received, after completion, 27 Jul 88) pp 19-22*

[Article by Yu. V. Berezin and I. P. Korotkov]

[Abstract] Full suppression of multiple-beam interference which has propagated along with radio waves through an ionospheric channel is considered and the performance of a phased receiver antenna array acting as space filter is analyzed, a space filter being one with optimized vector of weight coefficients and radiation pattern in the vertical plane in which the wave vectors of all radio waves reflected by the ionosphere approximately lie. As an illustrative example is evaluated a space filter which consists of four antenna elements occupying the four corners of a square, (with a half-wavelength distance between adjacent antenna elements square) and with an isotropic radiation pattern. Figures 3; references 6: 2 Russian, 4 Western (2 in Russian translation).

UDC 621.396.969.3:681.322.001.2

#### **Characteristics of Digital Detectors for Packets of Noncoherent Pulses**

*18600240e Moscow RADIOTEKHNIKA in Russian No 5, May 89 (manuscript received, after completion, 8 Jun 88) pp 23-25*

[Article by V.Yu. Zotov and V.D. Razevig]

[Abstract] Digital detection of a packet of noncoherent pulses is considered and two algorithms of such a detection are comparatively evaluated from the standpoint of execution by microprocessor. The algorithm with linear storage of envelope readings by a square-law detector is found to be more efficient than the algorithm with quadratic storage and four-level quantization by an analog-to-digital converter is shown to be adequate in terms of threshold signal-to-noise ratio as well as correct-detection probability, an appreciable improvement over two-level quantization and not significantly worse than quantization into more than four levels. Figures 4; references 4: 3 Russian, 1 Western (in Russian translation).

#### **A Conditional Probability Approach to Prediction of Radiowave Attenuation in Snow Storms on Horizontal Routes**

*18600244a Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 34 No 5, May 89, pp 903-908*

[Article by V. N. Pozhidaev, L. P. Trukhanova, M. N. Khaykin]

[Abstract] This study proposes a calculation model based on relations obtained by processing data on the spatial intensity distribution of snowfall regions measured by the weather radar computer system used at the Central Aerological Observatory in Dolgoprudniy. This approach to predicting the probability of radiowave attenuation on the route eliminates the need to artificially introduce the effective diameters of the snowfall regions or the effective route lengths. Each possible snowfall intensity profile on the route has its own calculated probability. The scanning range of the weather radar computer system in this case is a near-horizontal circle consisting of 3600 quadrants. Quadrant size in a polar coordinate system is 3 km in range and 3° in azimuth. The radar reflectance of the snowfall for a given quadrant was converted into snowfall intensity. The additional probability distribution was obtained by processing data on the spatial distribution of snowfall intensity based on these radar measurements, thereby allowing estimation of the probability distribution of snowfall intensity at the weather radar site. The authors conclude that the forecasting method discussed here requires a thorough experimental test which in turn

requires experimental data on the probability distributions in the various weather regions around the country.

UDC 61.371.32.01

**Closed Model of Rain for Prediction of Statistics of Attenuation of Radio Waves on Single and Space-Diversity Paths**

18600259A Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 34 No 6 Jun 89 (Manuscript received 25 Dec 87), pp 1127-1134

[Article by V. A. Korotkov, A. N. Rukina, Ye. V. Sukhonin]

[Abstract] A closed model is created for prediction of the integral distribution of attenuation of radio waves in rain showers over single  $p$  as well as joint integral distributions of attenuation over two space-diversity paths. The autocorrelation function defined by the model is compared with the measured function for strong rain showers. The functions are similar, indicating good agreement between the predicted results of combined attenuation statistics of millimeter waves over the two space-diversity paths using the closed model developed and an earlier method requiring information on the spatial autocorrelation function of rain intensity. The closed model suggested thus allows accurate prediction of the statistics of radio wave attenuation in space diversity transmission without requiring previous knowledge of the function  $p(L)$ . Figures 3; References 22: 7 Russian, 14 Western.

UDC 537.874.2.01

**Analysis of Reflection of Radio Waves from Active Plane-Layered Medium**

18600259B Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 34 No 6 Jun 89 (Manuscript received 14 Aug 86), pp 1135-1142

[Article by G. D. Mikhaylov]

[Abstract] A theoretical analysis is presented of the reflection of electromagnetic waves from an active plane-layered medium, generally consisting of adjacent non-controlled layers of an active dielectric or magnetodielectric which are thin in comparison to the wavelength of periodic conducting grids of controlled passive or active layers and a shield. The analysis establishes the possibility of increasing the intensity of the third reflected harmonic and confirms the basic equation describing reflection of radio waves from metallic objects with nonlinear elements, which were previously

derived on the example of a simple dipole with a nonlinear load. Figures 5; References 21: 11 Russian, 10 Western.

**Center-of-Gravity Image Fluctuations in Optical Detection and Ranging in a Turbulent Atmosphere**

18600273a Moscow *IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA* in Russian Vol 32 No 6, Jun 89, pp 673-678

[Article by G. Ya. Patrushev, O. A. Pelymskiy, A. I. Petrov]

[Abstract] This study carries out an analysis of the center-of-gravity image fluctuations of a reflector disk, corner reflector, and a two-dimensional reflector array used in optical detection and ranging systems under conditions of strong atmospheric intensity fluctuations. Both weak and strong fluctuations in radiation intensity through the collection aperture of the telescope were implemented for the measurements. Monomode radiation from an LG-38 laser producing approximately 55 MW at  $\lambda$  equals 0.63  $\mu\text{m}$  was guided along the atmospheric path where a reflector was mounted to guide the laser to the receive telescope objective. Center-of-gravity image fluctuations were studied for the various types of reflectors as a function of the diameter of the detector aperture. The analysis indicates that such fluctuations are largely dependent on the type of reflector utilized with the results varying substantially depending on whether disk reflector, a corner reflector, or an array of reflectors is used.

**The Perturbed Region Near a Spherical Antenna and its Capacitance in a Collisionless Plasma at Frequencies Between the Ion and Electron Plasma Frequencies**

18600273b Moscow *IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA* in Russian Vol 32 No 6, Jun 89, pp 679-686

[Article by S. A. Gorbunov, T. L. Potapova]

[Abstract] This study carries out an analysis of the perturbation region arising in the vicinity of a spherical electrode and its impedance characteristics for the case where the frequency lies between the ion and electron plasma frequencies. The calculations of the field potential are carried out for a sphere of radius greater than or less than the Debye radius of the plasma and both the static and dynamic capacitances are determined. The study derives rather simple expressions that determine the electrical field potential and the field strength near the antenna for these cases. The results derived from this study can find applications in interpretation of impedance measurements of plasma parameters that utilize antennas similar to those employed in the present study.

UDC 621.391.26

**Processing of Signals With Constant False-Alarm Level: Review**

18600213a Kiev IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA  
in Russian Vol 32 No 4, Apr 89 (manuscript received  
1 Jun 88) pp 4-15

[Article by P.A. Bakulev, Yu.A. Basistov, and V.G. Tugushin]

[Abstract] Processors with threshold control for signal detection with a constant false-alarm level are described, the threshold being formed by the "sliding window" method. A one-dimensional "window" is formed in the frequency (velocity) domain or in the time (distance) domain. A two-dimensional "window" is formed in the distance-velocity plane or in the distance-azimuth plane. The decision rules for such processors are based on apriori information about the interference, the latter being treated as one uniform and stationary within the "window" (model 1) or as one with jumpingly nonuniform power within the "window" (model 2) or as one uniform with jamming targets within the "window" (model 3). Processors of this kind fall into four classes, each being compatible with any of the three interference models. In the first class belong processors which average the power over elements of the "window." In the second class belong processors which use various logics in elements of the "window." There are two groups of processors in this class, processors selecting "the larger of" or "the smaller of" or using hybrid logic and processors using logic with detection of the interference edge as well as of jamming targets. In the third class belong processors operating on the basis of order statistics with some percentile used as estimate of the noise power. The rank of the percentile represents a tradeoff between maintenance of a given low false-alarm level and decrease of the signal-to-interference ratio combined with masking of the target by the interference edge and by jamming targets. This class includes processors with binary quantization of the input signal. Processors of the fourth class are adaptable to parameters of other than Rayleigh distributions of interference amplitudes, of Weibull distribution and log normal distribution as well as of nonparametric ones. There are processors which use scan cycle rather than time "sliding windows" for each distance (velocity) element. Figures 24; references 52: 5 Russian, 47 Western.

UDC 621.391.26

**Detection of Signals With Arbitrary Doppler Frequency in Presence of Correlated Gaussian Background Interference**

18600213b Kiev IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA  
in Russian Vol 32 No 4, Apr 89 (manuscript received,  
after revision, 3 Aug 87) pp 21-27

[Article by V.M. Froluskhin]

[Abstract] Suboptimum detection rules for signals with unknown amplitude, initial phase, and Doppler frequency in the presence of correlated Gaussian interference with unknown parameters are derived, one on the basis of discrete Fourier transformation and one based on variable degrees of freedom. In a finite sample size a discrete Fourier transformation lowers the degree of correlation between  $y_{ik}$  coordinates of vector  $Y_i$  and coordinates of vector  $X_i$ . Variable degrees of freedom involve approximate replacement of correlated coordinates with independent coordinates, utilizing a spherical approximation of the multi-dimensional Gaussian distribution. Two problems are solved by both methods, binary detection being one of them. The other one is testing the hypothesis "absence of signal" against alternative hypotheses "presence of signal" with Doppler frequency within a range determined by the sample size, this problem being readily solved according to the conventional sufficiency-plus-invariance scheme. Both detection rules are compared with the optimum one and, as a matter of relevant interest, the latter is compared with the optimum detection rule for signals with known Doppler frequency. Figures 2; references 6: 5 Russian, 1 Western (in Russian translation).

UDC 621.391.26

**Detection of Space-time Signals in Presence of Background Fields Scattered by Clouds of Hydrometeors**

18300213c Kiev IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA  
in Russian Vol 32 No 4, Apr 89 (manuscript received,  
after revision, 11 Apr 88) pp 28-32

[Article by I.Ya. Kremer (deceased), V.M. Petrov, and V.A. Tabatskiy]

[Abstract] Detection of signals in the presence of background fields scattered by a cloud of hydrometeors is

considered and an optimum space-time processing algorithm of detection by a multipositional diversity antenna array is constructed, for the case where no decorrelation of such an interference field takes place at the receiver points. The signal-to-interference energy ratio is calculated, assuming that the interference is approximately stationary and that the signal wavelength is sufficiently large for making the theory of Rayleigh scattering by discrete precipitates applicable. The algorithm is tested on a linear equidistant antenna array with a uniform gain distribution and is compared with the quasi-optimum algorithm which assumes that decorrelation of the interference fields takes place at the receiver points. Figures 2; references 6: 5 Russian, 1 Western (in Russian translation).

UDC 621.396.6

#### **Asymptotic Efficiency of Square-law Interperiodic Compensators for Noncoherent Moving-Target Selector Systems**

18600213d Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 32 No 4, Apr 89 (manuscript received, after revision, 25 May 88) pp 49-54

[Article by A.Z. Kiselev]

[Abstract] The characteristics of a noncoherent square-law compensator are evaluated, by spectrum analysis, for suitability as interperiodic compensator in noncoherent radar systems with moving-target selectors. An asymptotic expansion is obtained for the efficiency of such a compensator, also an exact expression for the maximum efficiency. The results of numerical calculations indicate that the asymptotic expression becomes sufficiently accurate already with 15-20 pulses in a processed signal packet. Figures 3; references 4: Russian.

UDC 621.396.967:629.735.38

#### **Moving-target Selector in Synthetic-Aperture Radar**

18600213e Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 32 No 4, Apr 89 (manuscript received, after revision, 19 Jan 88) pp 54-58

[Article by M.N. Surkov and V.P. Fedosov]

[Abstract] Selection of slowly moving targets in a moving synthetic-aperture radar by space-time processing of echo signals is considered, signals being received by tow unidirectional antennas whose axes are perpendicular to the velocity vector of the radar carrier and whose phase centers are spaced across the radar base. The algorithm of such a selection is constructed and evaluated, assuming that a stationary or moving point target on ground does not move beyond a resolution element while the radar aperture is synthesized. The selector consists of two controlled phase shifters, an adder, two correlators, two devices extracting the real part from the complex envelope of input signals, a subtractor, two threshold devices, and a coincidence circuit. An analysis of its

operation indicates the range of target velocities it can efficiently estimate and the necessary number of channels. Figures 3; references 5: Russian.

UDC 621.396.967.153

#### **Potential Accuracy of Measurements of Bistatic Sum-difference Doppler System**

18600213f Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 32 No 4, Apr 89 (manuscript received, after revision, 29 Feb 89) pp 59-63

[Article by I.A. Plotnikov, Ye.A. Tertyshnikova, and V.V. Chapurskiy]

[Abstract] Estimation of the parameters of a rectilinear target trajectory on the basis of measurements with a two-positional sum-difference diversity Doppler system a bistatic radar is analyzed for potential accuracy in consideration of potential measurement errors. The error and accuracy analysis demonstrated numerically on two variants of frequency measurements. In the first mode are measured two frequencies proportional respectively to the sum and the difference of two radial velocities relative to two diverse points, the frequencies being those of Doppler beat signals. In the second mode are measured two frequencies equal respectively to the sum and the difference of those two Doppler beat frequencies at the same two receiver points. Figures 1; references 3: 1 Russian, 2 Western (both in Russian translation).

UDC 621.391

#### **Construction of Algorithms for Recognition of Radio Signals Represented by Code Combinations**

18600213g Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 32 No 4, Apr 89 (manuscript received, after revision, 28 Jan 88) pp 63-68

[Article by V. P. Rummyantsev]

[Abstract] Discrete probability distributions of code combinations representing radio signals are established in the form of simple Markov chains, for recognition of such signals by processing of their envelope, the envelope squared, or its two quadrature components. On this basis are then constructed optimum algorithms of signal recognition from a set of correlated readings in accordance with the Bayes rule of minimum average risk. The initial envelope of a radio signal is approximated with a beta-distribution, such an approximation being most accurate, while its square fits a gamma-distribution and its two quadrature components fit normal distributions. Since a nonlinear transformation of a Gaussian distribution will not yield a multidimensional beta-distribution of readings of a correlated random process in an analytical form, two-dimensional probability density functions for the beta-distribution are represented in the form of series in orthogonal polynomials. As weight functions

are used one-dimensional probability density functions. These functions and the (0,1) interval of beta-distribution existence determine the choice of orthogonal polynomials for the two-dimensional probability density functions, namely Jacobi polynomials. Figures 2; references 8: Russian.

UDC 621.396.67

### Multitarget Monopulse Direction Finder of Noise Emission Sources

18600213h Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 32 No 4, Apr 89 (manuscript received 28 Mar 88) pp 69-74

Article by V.N. Manzhos and L.I. Rudnev]

[Abstract] Adaptive direction finding of noise emission sources on the basis of their correlation matrix containing information about their angular coordinates is reconsidered, sequential scanning of space by mathematical scanning with a three-dimensional reference signal having been found to be slow and to yield biased estimates when the noise sources are time-correlated. Parallel scanning is examined as a preferable alternative which does not require mathematical scanning with a reference signal, two angular coordinates being simultaneously and unambiguously estimated at two outputs of a linear or plane antenna array with shifted phase centers upon arrival of two beams of sample oscillation correlation matrices. The direction finder is simplified accordingly, but into account are also taken nonideal initial conditions and likely time correlation of the noise sources, which in this case does not critically influence the estimates about their coordinates. Figures 4; references 3: 1 Russian, 2 Western.

UDC 621.391.827

### Effectiveness of Using Complex Signals for Interference Suppression

18600213i Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 32 No 4, Apr 89 (manuscript received, after revision, 31 Mar 88) pp 82-84

[Article by V.V. Barlabanov, S.A. Serykh and A.I. Zvyagin]

[Abstract] The effectiveness of phase-shift keying, frequency-shift keying, and frequency-shift-phase-shift keying discrete signals is evaluated in terms of resulting interference suppression, assuming that signal and interference are statistically independent narrow-band processes. As measure of effectiveness serves as quotient, output signal-to-interference power ratio divided by input signal-to-interference power ratio, and as model of interference suppression is considered convolution of interference with a replica of the useful signal in a receiver consisting of a multiplier followed by a band-pass filter and a demodulator output stage. In order to

calculate the effectiveness quotient, which is simple for signal and interference with uniform spectral density each, in the case of narrow-band ones it becomes necessary to maximize the interference dispersion functional on the set of possible interference spectra for each kind of signal. The best signal is then the one with which the worst interference is suppressed most. Partial solution of this signal selection problem by the sorting method indicates that phase-shift keying is most effective and frequency-shift keying is least effective, frequency-shift-phase-shift keyed discrete signals being most vulnerable to interference within peaks of the signal spectral density at frequencies equal to multiples of the frequency deviation. Figures 1; references 5: Russian.

### Polar-Logarithmic Image Conversion Pattern Recognition System

18600214c Moscow RADIOTEKHNIKA in Russian No 4, Apr 89, pp 8-10

[Article by A. M. Bereznyy, Yu. D. Dumarevskiy, N. F. Kovtonyuk, A. N. Kozlov, V. S. Kolobkov, G. A. Petrovicheva, S. S. Stepanov]

[Abstract] This article analyzes an invariant holographic correlator based on a joint Fourier transform scheme. The entrance stages of the correlator transport the compared images to the coherent carrier where the Fourier transforms are produced. This centers the processed signals relative to the optical axis which is required for subsequent polar logarithmic conversion. This is implemented by square-law signal detection by optically-controlled transparencies and by multiplying the results by the transmission function of the optical filter followed by Fourier transformation. This produces correlation of two images inverted by a random angle. The maximum spatial frequency of the compared images was limited to  $20 \text{ mm}^{-1}$  by the carrier frequency of the synthetic optical filter. The signal-to-background ratio in the correlation plane was 10:1 for images with a  $90^\circ$  angular mismatch. These results confirm the promise of polar-logarithmic image conversion systems for random-configuration pattern recognition systems.

### A Digital Adaptive Phased Antenna System

18600214e Moscow RADIOTEKHNIKA in Russian No 4, Apr 89, pp 70-71

[Article by A. S. Afromeev, I. A. Naumov]

[Abstract] This article proposes a digital adaptive phased antenna system to correct a common problem in phased antenna arrays where information stored in the memory and the adaptive units remains unchanged during the entire series of samples. The digital adaptive phased antenna system proposed in this study eliminates this drawback by incorporating a comparison to the true signal detected in the preceding samples. This is achieved by incorporating a legitimate signal detection, accumulation and storage unit in the digital adaptive phased antenna system. This information is then used in

all subsequent operational stages of the phased antenna array for comparison to the information stored in the memory and the adaptive unit and for correlation depending on the true signals received. The entire system consists of a phased antenna array, a directional pattern generation circuit employing an analog-to-digital converter, a processor, the adaptive unit, the memory, and the legitimate signal detection, accumulation and storage unit. The article contains a detailed description of system function as well as the specifications of a system prototype fabricated by means of optical fibers and manufactured by the Institute of Radioelectronics and the Institute of Cybernetics of the USSR Academy of Sciences.

### Enhancement of Photodetector Speed

18600214f Moscow *RADIOTEKHNIKA* in Russian  
No 4, Apr 89, pp 75-77

[Article by V. N. Myasnikov]

[Abstract] This article employs a number of standard photodetector circuit designs to estimate the ultimate capabilities of such photodetectors and to consider possible techniques for improving their speed and sensitivity. The analysis focuses on the proper application of negative capacitance simulators as a means for optimizing the speed and sensitivity of such circuits. The article gives several standard photodetector circuit configurations and appropriate specifications, including the negative current impedance and the negative voltage impedance. The analysis suggests that it is possible to substantially improve the speed of devices limited by parasitic input capacitance by proper selection of negative capacitance simulators.

### Implementation of Effective Integration Techniques for Analyzing Multicycle Electronic Circuits

18600214g Moscow *RADIOTEKHNIKA* in Russian  
No 4, Apr 89, pp 82-86

[Article by A. S. Belotserkovskiy, Yu. A. Yevstifeev]

[Abstract] This article proposes a family of AL-stable techniques for numerical integration of ordinary differential equations. This family of AL-stable methods have differing degrees of accuracy in order to effectively analyze all classes of multicycle electronic circuits. The study derives the appropriate  $n$ th order ordinary differential equations and discusses the solutions from an expansion in a system of Legendre polynomials. This leads to the development of an algorithm for implementing a single integration step of the derived equation system and the algorithm text is provided. The study also carries out test calculations of resonant circuits to test these methods. The accumulation of integration error over the period of oscillations in steady-state conditions were determined in these calculations. The calculation results indicate that the necessary number of integration steps diminishes with increasing order of the method.

Consequently it is possible to select a method that minimizes the number of calculations for analyzing a specific multicycle electronic circuit from the entire family of techniques described in the article.

### The KM1816VE48/35 Series Single-Chip Microcomputers

18600214h Moscow *RADIOTEKHNIKA* in Russian  
No 4, Apr 89, pp 90-91

[Unattributed article]

[Abstract] The KM1816VE48/35 Series integrated circuits are 8-bit single-chip computers designed for local data processing applications (equipment control, test instruments, etc.). This series includes several specific integrated circuits including the KM1816VE48 (a single-chip computer with an internal 1024 byte ROM), the KM1816VE35 (no chip ROM and can be used with any external LSIC ROMs, 64 byte RAM capacity), the KR1816VE49 (a single-chip computer with a 2 kbyte internal REPROM, a customer-programmable chip), and the KR1816VE39 (a single-chip computer with no chip ROM and 128 byte RAM). The primary specifications of the KM1816VE48/35 series single-chip computers are: data word size, bits: 8; instruction word size, bits: 8; RAM capacity, bytes: 64; ROM capacity, bytes: 1024; clock frequency, MHz: 1-6; speed, operations per second: 400; total power consumption, mA: 135; supply voltage, V: 5; and erasable ROM storage time, hours: 25,000.

### The K1816VE51 Series Single-Chip Microcomputers

18600214i Moscow *RADIOTEKHNIKA* in Russian  
No 4, Apr 89, pp 91-92

[Article by M. I. Maslov, V. V. Pavlov]

[Abstract] The K1816VE51 series integrated circuits are 8-bit single-chip microcomputers designed for a broad range of microcontroller devices. This series includes the following large-scale integrated circuits: the KR1816VE51 containing a 4096 byte customer-specified mask-programmable ROM designed for use in mass manufacturing; the KM1816VE751 containing a UV erasable 4096 byte ROM, and the KR1816VE51 which has no internal program memory although it can use up to 64 K external RAM or reprogrammable memory and is employed in systems with a memory capacity up to 4 K. The chip contains 20 special purpose registers at fixed addresses in the RAM address space in registers 128 through 256. These are designed for controlling timer, input-output and interrupt operation. The specifications of the K1816VE51 series single-chip computer includes: data word size, bits: 98; instruction word size, bits: 8; RAM memory (data memory), bytes: 128; ROM memory (program memory), Kbytes: 4; clock frequency, MHz: 1.2-12; duration of single instruction execution cycle, mcs: 1; supply voltage, V: 5; fabrication technology:  $n$ MOS.



### An Analytical Compositional Model of Information System Efficiency

18600220a Leningrad IZVESTIYA VYSSHIKH UCHEBNIKH AZVEDENIY:

PRIBOROSTROYENIYE in Russian Vol 32 No 4, Apr 89, pp 3-6

[Article by I. N. Yevtushenko]

[Abstract] This article discusses systems of efficiency, quality, and optimization models for application to computer systems and develops an analytic model relating the efficiency of an information system to the computerization level. This model differs from other analytical models in that the characteristics in the macrocoordinate systems in the model plane averaged over a certain time are the only properties accounted for. The model also uses a common principle whereby the efficiency of a heterogeneous system is evaluated by the difference of the input and output indicators. This is then used as the basis for constructing the analytical compositional model of the efficiency of the information system. Several existing models can be derived from this model as particular cases. The model proposed in this article illustrates the interrelationship of the primary indicators (efficiency, quality, etc.) of information hardware and systems and can be used for systems problems and optimum design.

### One Possibility for Analyzing the Periodic Structure of a Complex Signal

18600220b Leningrad IZVESTIYA VYSSHIKH UCHEBNIKH AZVEDENIY:

PRIBOROSTROYENIYE in Russian Vol 32 No 4, Apr 89, pp 6-11

[Article by Yu. A. Polkanov, V. N. Kudinov]

[Abstract] This study considers employing structural analysis of a statistically generalized signal to detect complex periodic signal structures against a background of stronger, aperiodic variation. The technique focuses on the time intervals between the local signal extrema for use as the characteristics of the periodic components in the signal structure. The technique is most suitable for use with signals of complex periodic structure and stochastic elements occurring in the nonlinear modulation of harmonic signals in noisy conditions. The analysis of this approach employed a decaying model signal with a complex periodic structure with both "positive" and "negative" sections. The approach was formulated for three simple signals: a linearly decaying signal, and two sinusoidal signals separated in frequency by a factor of 1.5 with equal amplitudes and initial phases. Processing results for these signals are given for the case where the signal structure is represented as the aforementioned set of characteristic "positive" and "negative" elements. In this configuration the discrete set of statistically-established intervals accounting for the amplitudes of the corresponding components yields complete information on the precise structure of the modulated signal. The

results obtained from this study confirm the promise of using structural analysis to detect complex periodic signal structures against a background of a more substantial aperiodic variability. Additional advantages of this technique include independence of the results from the signal sampling length, simple implementation, and high speed.

### Vernier Pulse-Time Coding of Periodic Signals

18600220c Leningrad IZVESTIYA VYSSHIKH UCHEBNIKH AZVEDENIY:

PRIBOROSTROYENIYE in Russian Vol 32 No 4, Apr 89, pp 48-51

[Article by V. I. Yemelyanenko, V. A. Lipatov]

[Abstract] This study considers one possible method of reducing digitization error for the case of large digitization steps. The error is reduced by enhancing the estimate of the period of an expanded signal by means of phase interpolation. The study derives an expression that represents an improvement on existing results which are based on an approximate equality of the two compared time intervals of pulses from neighboring pulse packets, while the relation derived here represents an exact analytic expression of the period of the expanded signal. This technique can be used to determine the period of the expanded signal with a high degree of accuracy with any digitization steps. One additional advantage of this approach is that the interpolation transforms need not be carried out over an extended range of time intervals but only within the digitization step, which is substantially shorter than the length of the compared periods. This serves to enhance the sensitivity of the interpolator. The principles examined in this study can be used to reduce digitization error in the case of large digitization steps in vernier conversion and can simultaneously eliminate the primary systematic error components characteristic of combined transducers.

### Noise Immunity Enhancement of Bipolar Signal-to-Square Wave Pulse Time-Frequency Transducers

18600220d Leningrad IZVESTIYA VYSSHIKH UCHEBNIKH AZVEDENIY:

PRIBOROSTROYENIYE in Russian Vol 32 No 4, Apr 89, pp 52-55

[Article by N. M. Bondar, N. I. Markin]

[Abstract] This study analyzes the possibility of enhancing the noise immunity of bipolar signal-to-square wave pulse time-frequency transducers. The study proposes using adaptive inertial tuning of the null-detector as a function of the input signal amplitude. The null-detector is based on an operational amplifier under unidirectional positive feedback. The unidirectional positive feedback is required to block the null-detector during zero legitimate signal conditions. The study provides timing diagrams for the null detector

operation in circuit. Also given are theoretical relations for calculation and implementation of the converter circuitry and its performance characteristics. Transducer tests suggest that adaptive tuning of the threshold blocking voltage of the transducer can provide noise immunity depending on the input signal parameters in both the intervals between legitimate pulses and when the pulses themselves are present.

#### **Effect of Partial Illumination of the Entrance Pupil of an Optical System on Image Quality**

18600220e Leningrad IZVESTIYA VYSSHIKH UCHEBNIKH AZVEDENIY:  
PRIBOROSTROYENIYE in Russian Vol 32 No 4,  
Apr 89, pp 61-67

[Article by D. V. Belunskiy, A. V. Shikut]

[Abstract] This study analyzes the variation in optical system response to changes in entrance action resulting from partial covering of the entrance pupil of the optical system. The study derives expressions for the two-dimensional space-frequency response of a diffraction-limited noncoherent optical system. The analysis also derives a scattering function and an optical transfer function for different illumination schemes. These formulae were then used as the basis for constructing a computer program (YeS computer, FORTRAN-4) for calculating the frequency-contrast characteristics using a fast Fourier transform. Analysis of the expressions and calculation results indicates that the signal-to-noise ratio for the case of partial illumination of the entrance pupil of the optical system diminishes in proportion to the area of the illuminated pupil region.

#### **An Adaptive Pulsed Analog-to-Digital Converter**

18600222b Moscow PRIBORY I TEKHNIKA  
EKSPERIMENTA in Russian No 1, Jan 89, pp 115-119

[Article by A. N. Kuznetsov]

[Abstract] This article develops an analog-to-digital converter design which automatically drops the quantization step by a factor of K in order to enhance low amplitude pulse measurement accuracy. This adaptive analog-to-digital converter design is discussed and a schematic of the unit is given. Analysis reveals that the device will produce an increase in the discharge time (by a factor of K) for low amplitude signals which is equivalent to an equal reduction in the quantization step and therefore, the digitization error. Test results on analog-to-digital converter prototypes are reported together with different possible applications of the converter design. Such devices can be used in spectrometers with parametric scale stabilization.

#### **A Noise-Immune Compensated Voltage-to-Frequency Converter for Multichannel Measurement Systems**

18600222c Moscow PRIBORY I TEKHNIKA  
EKSPERIMENTA in Russian No 1, Jan 89, pp 120-122

[Article by O. V. Antonov, B. Z. Buzumurga, V. A. Burdelyniy, I. I. Palamarchuk, O. Yu. Piskov, M. F. Rybak]

[Abstract] This article reports the development of a noise-immune compensated voltage-to-frequency converter which is designed as an integrated voltage-to-frequency converter producing a specific pulse repetition rate. This unit contains an input comparator, a matched photodetector, a d.c. amplifier, a quartz-stabilized master oscillator, an integrator, a reference voltage source, a control pulse shaper, a current stabilizer, a pulse transformer, and a radiator. This device is unique in that it employs a fiber-optic communications link to the information receiver and employs adaptive correction by means of a second fiber-optic channel. The converter has a conversion error of less than plus or minus 1 percent and a voltage range of 25 mV to 300 mV and can operate in a temperature range of -20 to +60°C. The unit can be employed in multichannel telemetry data acquisition and processing systems in field conditions where high sensitivity and a high degree of protection from spurious radiation, electromagnetic noise and interference is required.

#### **A 1 MeV Section for High-Power, High-Current Pulsed Generators**

18600222d Moscow PRIBORY I TEKHNIKA  
EKSPERIMENTA in Russian No 1, Jan 89,  
pp 137-139)

[Article by B. M. Kovalchuk, V. A. Kokshenev, A. A. Novikov, V. P. Yakovlev]

[Abstract] This article reports a new design of a 1 MeV section for a 10 MJ generator. The section is a pulsed voltage generator in Arkadev-Marx configuration consisting of 12 stages. Each stage consists of four IK-100-0.4 capacitors in two parallel configurations. The capacitors are mounted on screen ledges connected on both sides to delta-tree bays. The screens are fabricated from pipes. Performance tests on the 1 MeV section are reported and possible applications are discussed, particularly to plasma physics. This section lends itself to high-power applications by employing several sections in series. The section specifications include: number of IK-100-0.4 capacitors per stage: 4; number of stages: 12; charge voltage: 20-85 kV; output voltage: 1 MeV; stored energy: 69 kJ; inductance: 1.8 mH; dimensions 1.6 by 0.56 by 2.4 cubic meters; weight: 2 tons.

**Ultra-High-Frequency Subnanosecond Current Pulse Generator**

18600222e Moscow *PRIBORY I TEKHNIKA*  
*EKSPERIMENTA* in Russian No 1, Jan 89, pp 146-148

[Article by V. P. Dyakonov, P. G. Adamov, V. M. Vatutin, P. G. Vanichkin]

[Abstract] This article reports the development of an ultra-high-frequency subnanosecond current pulse generator employing a microstrip controller and pulse shaper based on power field-effect GaAs transistors. This unit produces current pulses for pumping a heterolaser diode with the desired temporal and frequency properties. The unit employs AP602 and AP603 gallium-arsenide FETs. A schematic of the current pulse generator is given together with timing diagrams of the output voltage from the master oscillator. The leading and trailing edges of the pump pulses amount to approximately 80 ps at a current of 100 mA and a pulse repetition rate of approximately 2 GHz. Experimental analysis has revealed that the temporal frequency instability of the generator was less than 0.1 percent with temperature variations from 10 to 35°C. The unit is constructed on a 90 by 55 by 20 cubic millimeter board with the  $a_1$  and  $a_2$  components of the master oscillator fabricated using XC22 material.

**Fast High-Power Short-Circuit Protection Systems for Electrical Equipment**

18600222F Moscow *PRIBORY I TEKHNIKA*  
*EKSPERIMENTA* in Russian No 1, Jan 89,  
pp 155-158)

[Article by A. A. Novikov]

[Abstract] This article analyzes a variety of fast high-power short-circuit protection designs for application to electrical equipment. The design of a protection device employing an Arkadyev-Marx generator is examined and the trigger time of the unit is plotted and calculated. A modification on the design that incorporates a pulsed air-core transformer is discussed and a diagram of this device is given. The device employs an opposing configuration of the secondary windings thereby imparting resistance to pulse voltages injected to the protected

equipment. At voltage rise rates of up to 5 times  $10^{11}$  volts per second no false trips were recorded. The designs examined in this article provide reliable protection to electrical equipment operating at high power and voltage levels.

UDC 621.378.325

**Generation of Ultrashort Radiation Pulses in High-Gain Solid-State Active Media**

18600228d Kiev *IZVESTIYA VYSSHIKH*  
*UCHEBNYKH ZAVEDENIY: RADIOFIZIKA*  
in Russian Vol 32 No 3, Mar 89 (manuscript received  
18 May 87) pp 369-379

[Article by O. P. Varnavskiy, A. M. Leontovich, A. M. Mozharovskiy, and N. V. Sidoruk, Institute of Physics imeni P. N. Lebedev, USSR Academy of Sciences]

[Abstract] Generation of ultrashort radiation pulses in YAG:Nd and ruby lasers with self-locking of modes by means of a saturable absorber is analyzed theoretically, assuming a quasi-steady absorption saturation. It is analyzed for repeatability of a single pulse with identical radiation characteristics within one cavity period, considering that this is determined by the ratio of absorber brightening to active medium saturation and that instability of this ratio can be caused by instability of the pumping radiation as well as by fluctuations of emission intensity spikes at the beginning of the nonlinear stage. The "second threshold" for generation of a giant pulse and ultrashort pulses is calculated on this basis. Effects of self-action in a high-gain active medium are shown to be negligible so that the envelope and the energy characteristics of a pulse train are determined solely by the giant pulse dynamics and the solid-state laser can be optimized accordingly. Formation of ultrashort pulses is subsequently analyzed on the basis of about 1,000 numerical experiments in accordance with the three equations of laser kinetics for the rates of change of populations and photon flux density respectively, with various values of active medium and absorber parameters as well as various initial conditions. The results indicate that reliable self-locking of modes is attainable with an optically dense nonlinear absorber. The authors thank A. N. Kirkin for assistance. Figures 5; references 32: 17 Russian, 15 Western (2 in Russian translation).

UDC 621.314

**Energy Characteristics of Pulse-Type D.C. Voltage Regulators With High-Voltage Transistors**

18600229b Kiev *TEKHNICHESKAYA ELEKTRODINAMIKA* in Russian No 2, Mar-Apr 89 (manuscript received 1 Jul 88) pp 19-24

[Article by Academician (UkSSR Academy of Sciences) Anatoliy Korneyevich Shidlovskiy, director, Oleg Nikolayevich Yurchenko, graduate student, Vladimir Mikhaylovich Skidanov, candidate of technical sciences, senior scientific associate, and Viktor Borisovich Pavlov, candidate of technical sciences, senior scientific associate, Institute of Electrodynamics, UkSSR Academy of Sciences, Kiev]

[Abstract] The energy characteristics of high-voltage power transistor switches and of pulse-type d.c. regulators with such transistors are evaluated, considering that design optimization must also include reliability and size indicators. A conventional high-voltage regulator circuit and one with emitter commutation are compared with respect to efficiency under normal conditions and losses under a short circuit across the voltage source or across the load. Calculations are based on current-voltage-time relations, with the source voltage and the average switch current during a pulse as absolute reference parameters. They follow the Pavlov-Skidanov method, which reduces the regulator into three components: 1) transistor switch, 2) voltage source (with internal resistance) and parallel input capacitance on the collector side, 3) load resistance and parallel output capacitance behind shunting diode and series inductance on the emitter side. Numerical data on a conventional switch with one KT838A or KT839A transistor and on an emitter commutator switch with two transistors, a KT838A and a KT908 or a KT839A and a KT908A, indicate that switches with KT839A transistors are more efficient than those with KT838A transistors over the entire range of voltage regulation. While the dynamic characteristics of both transistors are identical, losses at the saturation level are higher in a KT838A than in a KT839A. At higher frequencies, moreover, dynamic losses in the switch become overriding. An emitter commutator switch is much more efficient than a conventional one at small ratios of on-time to pulse period and, therefore, allows for a wider range of voltage regulation and a higher switching frequency. Figures 5; references 7: Russian.

UDC 621.383.2.014.2

**Selection of Structure for Pulse-Type Chopper With Thyristors**

18600229c Kiev *TEKHNICHESKAYA ELEKTRODINAMIKA* in Russian No 2, Mar-Apr 89 (manuscript received 23 Nov 87) pp 35-39

[Article by Oleg Nikolayevich Sinchuk, candidate of technical sciences, prorektor, Nina Dmitriyevna Mitsnaya, engineer, and Igor Anatolevich Lutsenko, engineer, Krivoy Rog Institute of Mining]

[Abstract] An algorithm is constructed to facilitate computer-aided design of the optimum structure for a pulse-type chopper with thyristors which will satisfy basic criteria such as efficiency, chopping frequency, and range of output voltage regulation as well as any other criteria depending on the specific application. The problem is treated as one of multicriterial multistep vector optimization with use of appropriate weight coefficients with the input data. As an example is considered the structure of a chopper for regulation of the d.c. drive in a new electric ore transporting train with less available free space between cars than in an old train, the chopper size thus becoming a very important additional design criterion. Figures 1; references 5: 4 Russian, 1 Western.

UDC 621.314.21

**Principles and Technology of Designing End Zones in Large Electrical Machines With Aid of Computer**

18600229d Kiev *TEKHNICHESKAYA ELEKTRODINAMIKA* in Russian No 2, Mar-Apr 89 (manuscript received 9 Feb 88) pp 58-64

[Article by Academician (UkSSR Academy of Sciences) Gennadiy Grigoryevich Schastlivyy, deputy director, Aleksey Ivanovich Titko, doctor of technical sciences, laboratory manager, and Oleg Vladimirovich Gorda, junior scientific associate, Institute of Electrodynamics, UkSSR Academy of Sciences, Kiev]

[Abstract] Computer-aided design of the end zones in large electrical machines is proposed, their design requiring intricate calculations of electromagnetic fields. An application program package is needed, to ensure an efficient design procedure as well as an optimum and reliable design which meets not only performance but

also manufacturability criteria. Such an application program package is the KONZEM (END Zones Electrical Machines) developed in the USSR and compatible with USSR SM-1420 as well as IBM PC-XT/AT minicomputers. The package is modular and written in an input language most clearly understood, in terms of structure and terminology, by a professional designer of electrical machines. It includes software for interpretation and editing, also for graphics and access to a flexible reference information base with automatic filing of new problems and their solutions. It generally requires a large amount of computer time, the design of one end zone taking up to 4 hours. References 5: 4 Russian, 1 Western (in Russian translation).

UDC 621.396.6

### Method of Calculating Temperature Fields in Radioelectronic Apparatus Module Subject to Radiative Heat Transfer From Hot Surface

18600230b Novocherkassk IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 3, Mar 89 (manuscript received, after completion, 22 Jun 88) pp 78-81

[Article by Nikolay Aleksandrovich Tseligorov, candidate of technical sciences, senior scientific associate, Rostov Military-Command-Engineering College for Missile Crews imeni Chief Marshal of Artillery M. I. Nedelin]

[Abstract] Considering that the layout of integrated-circuit radioelectronic apparatus modules must ensure no overheating of components, the temperature field which a nearby hot surface induces inside such a module is calculated on the basis of a physically adequate and mathematically simple thermal model. It is the Stefan-Boltzmann law of radiative heat transfer from a hotter surface and the Lykov equation of transient heat conduction through a colder module component, with appropriate boundary conditions for both temperature and its gradient. Unilateral heating of thin plates by thick hot plates is considered and the dimensional relations in a module are taken into account. The method is demonstrated numerically on a 3 mm thick and 120 mm square textolite board carrying series 133 chips at -25°C initially, 50 mm away from a parallel to it 30 mm thick and 120 mm square steel plate at 200°C. Calculations by this method have yielded higher temperatures inside the textolite plate than measurements made in a matching experiment. Figures 1; references 3: Russian.

### A Method of Calculating the Parameters of a Portable Radio Packet Communications Network

18600232A Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian No 3, May-Jun 89, pp 48-51

[Article by L. V. Krasilovets, N. K. Pechurin, L. P. Kondratova, N. D. Drach, N. V. Zakharyashcheva]

[Abstract] This article analyzes several problems encountered in the design of frequency-division multiplexed radio

packet communications networks. The article also proposes a routine for calculating the parameters of a portable radio packet switching network, i.e., a network consisting of four lower levels of a reference model: the physical, channel, network, and portable levels. A routine is proposed for calculating the parameters of the radio network and for drafting a calculation algorithm. This routine consists of three principal stages. The first stage is the search for the initial channel distribution by solving a generalized assignment problem, i.e., to determine the number of channels of each type at the network nodes. The second stage involves reconstruction of the derived channel distribution accounting for the constraints on outlay. The third stage involves analysis of network operation by simulation. The article reports the development of an algorithm for this problem as a program package run on the INES version 3.5 database management system in the YeS operating system in the MVT and SVS modes. The analysis reveals that this cyclic routine for radio network design can be used to account for the mutual dependence of the various decisions made on the lower representative levels, which improves the design quality. The software set developed in this article can be used for timely calculation of packet radio network parameters.

### Analysis of Through Message Delay in a Multisectional Virtual Channel Communications Network

18600232b Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian No 3, May-Jun 89, pp 52-64

[Article by S. P. Sushchenko]

[Abstract] This study analyzes the through transmission time of messages on a multisection data transmission channel. This problem is analyzed by employing a model of a virtual data transmission circuit consisting of D internode links. The analysis assumes that the separate links of the circuit can jointly use different virtual connections. The delay of a multipacket message in an irregular virtual channel with a uniform configuration of identical packets in the sender queue is then found. This analysis reveals that the message delay is largely determined by the relations between the packet transmission times at successive levels of the virtual channel. Other possibilities are also examined such as the case of an inverse order of the packets in the queue prior to the message, as well as a random configuration of the packets in the queues and random relations between the packet transmission times on the various internode connections of the virtual channel. It is determined from an analysis of the through delay in a busy data transmission channel that the shortest message delivery time to a remote subscriber is achieved with an inverse configuration of the elements in the queue before the message regardless of the nature of the network traffic (packets of identical or different lengths). The article also identifies the invariance of the message delay to the queue structure at the beginning of the route.

UDC 621.396.96

### Accuracy of Measurement of Coordinates of Intricate Objects in Noncoherent Systems

18600240b Moscow *RADIOTEKHNIKA* in Russian  
No 5, May 89 (manuscript received 2 Jul 87) pp 9-10

[Article by N.A. Potapov]

[Abstract] Measurement of the coordinates of small objects which have finite dimensions and intricate shapes is analyzed for accuracy, in terms of probability that the signal-to-noise ratio squared at the output of a noncoherent multipositional or multifrequency system which collocates video signals after their detection is not smaller than the threshold signal-to-noise ratio squared and at the same time the system estimates any coordinate of the center of an object with an error not larger than the maximum allowable defined as accuracy criterion. The distribution of the normalized signal-to-noise voltage ratio during noncoherent reception of  $N$  independently fluctuating video signals is characterized as a chi-square distribution with  $N$  degrees of freedom, assuming a Rayleigh distribution of signal fluctuations. It is shown that as the ratio of r.m.s. object dimension to Woodward's resolution element decreases and thus dominant significance shifts from "target noise" to instrument noise, more degrees of freedom and thus more video signals are needed for attainment of a given probability of accurate measurements. Figures 2; references 6: Russian.

UDC 621.391

### Asymptotically Nonparametric Detector of Optical Signal

18600240f Moscow *RADIOTEKHNIKA* in Russian  
No 5, May 89 (manuscript received, after completion, 5 May 88) pp 62-65

[Article by A.P. Trifonov and T.M. Ovchinnikova]

[Abstract] A maximum-likelihood detector of optical signals is synthesized, assuming a priori unknown signal intensity, signal delay, and background noise intensity. The process at the detector input is considered to be a Poisson process appearing without or with a signal during the period of time in which the data are analyzed and both hypotheses are tested. The detector includes a switch open for the duration of input analysis, an integrating pulse counter, a delay line for signal-duration long time delay, two inverters, a delay line for analysis-duration time delay, two dividers, an amplifier with gain equal to ratio of analysis duration to signal duration, a logarithmic amplifier, an amplifier with gain equal to ratio of analysis duration to difference between analysis duration and signal duration, a switch open for the duration of input analysis plus either one of the time delays, a peak detector, and a threshold device producing a 1 or 0 output, also three adders and one multiplier. The

asymptotic value of false-alarm probability is independent of the background noise intensity, which has been confirmed experimentally, this therefore being an asymptotically nonparametric detector. Figures 2; references 6: 5 Russian, 1 Western (in Russian translation).

UDC 621.391.01

### Digital Filter for Suppression of $M$ Interfering Signals at Fixed Frequency

18600259C Moscow *RADIOTEKHNIKA*  
*I ELEKTRONIKA* in Russian Vol 34 No 6 Jun 89  
(Manuscript received 6 Jan 88), pp 1228-1231

[Article by S. Sh. Petker]

[Abstract] A study is made of the synthesis of a digital filter with  $M$  nulls for a signal consisting of a video pulse train modulated in amplitude and repetition frequency. The transfer function of the filter computed and illustrated graphically. An example of synthesis of a three element filter by means of a computer is presented. Figures 4; Reference 3: 1 Russian, 2 Western.

06508

UDC 621.372.832.01

### Frequency-Selective Microwave Element Producing Attenuation Poles

18600259D Moscow *RADIOTEKHNIKA*  
*I ELEKTRONIKA* in Russian Vol 34 No 6 Jun 89  
(Manuscript received 29 Dec 87), pp 1250-1254

[Article by V. M. Ocipenkov]

[Abstract] Elements are known which produce attenuation poles in certain areas of the plane of complex frequency, constructed of multiple conductor line sections with various boundary conditions at the ends of conductors. Known elements of this type have attenuation poles located points of zero and infinity, or at points far from the operating frequencies, thus having little influence on the amplitude-frequency characteristics. Control of the location of the attenuation poles with respect to the operating frequency is also difficult, since the location rigidly connected to the operating frequency. This article studies an element which does not have these shortcomings, producing attenuation poles at finite frequencies. The new element consists of a quadrupole made up two circuits connected in a closed loop. This element can be used in the design of low- and high-pass filters as well as band-pass filters with good filtration quality. Analytic expressions are presented for the circuit functions describing the element. The location of the nulls, poles and extremes of the attenuation function depends on the coordinate of the vector of variable parameters, which can be changed to form the desired amplitude-frequency characteristic of the element. Figures 3; Reference 5: Russian.



UDC 551.508.86

**Device for Recording USW Radiation of Lightning**18600259F Moscow *RADIOTEKHNIKA**I ELEKTRONIKA in Russian Vol 34 No 6 Jun 89*

(Manuscript received 30 Oct 87), pp 1315-1317

[Article by A. N. Belov, L. T. Remizov, V. S. Safanyuk, A. V. Elbakidze]

[Abstract] A study is made of techniques for recording the ultrashort-wave radiation of lightning by development of equipment designed simultaneously for analysis of the amplitude and time structures of the pulsed USW radiation of lightning. The equipment utilizes a vertical rod antenna with a horizontal ground consisting of 12 radial metal rods assuring a circular reception pattern in the vertical and horizontal planes. A double resonant filter provides primary filtration, and is followed by an amplifier with quasilogarithmic gain. The selective amplifier can be tuned between 40 and 100 MHz with a frequency bandwidth 6 MHz. This is followed by an attenuator which can vary the sensitivity of the receiver section by 30 dB, an analog-digital converter, time interval counter, memory unit, display, microcomputer-based controller and cassette tape recorder. Samples of data recorded by the device are presented. The data can be used to analyze the amplitude and time structure of the USW radiation generated by lightning storms. Figures 3; References 3: 2 Russian, 1 Western.

UDC 681.586:514.13

**Space of Physical Quantities and Its Use in Design of Transducers**18600260a Moscow *PRIBORY I SISTEMY**UPRAVLENIYA in Russian No 4, Apr 89 p 20*

[Article by V. A. Mazin, candidate of technical sciences, Leningrad Polytechnic Institute imeni M. I. Kalinin; annotation of article No 4448pr filed on 16 Nov 88 in Information Office for Measuring and Control Devices, 8 pp with 2 figures and 3 bibliographical references]

[Abstract] A mathematical apparatus which facilitates geometrical representation of a set of physical quantities is proposed for design of an instrument transducer complex and estimation of its accuracy, considering that a set of physical quantities has the properties of a Riemann space. Here, with the aid of a metric tensor, the complexity of conversion can be characterized in terms of number and "quality" of its components. The apparatus is applicable to analog-to-digital and digital-to-analog conversions as well. Figures 1.

UDC 681.325.5:007.52

**Database Management for Electromechanotronic Transducers**18600263a Moscow *PRIBORY I SISTEMY**UPRAVLENIYA in Russian No 6, Jun 89 pp 18-20*

[Article by V. G. Domrachev, doctor of technical sciences, and Yu. S. Smirnov, candidate of technical sciences]

[Abstract] Database management for a microprocessor-aided high-speed electromechanotronic displacement transducer is analyzed, such a transducer used in robots consisting of a coordinate transformer, a self-switching rectified-d.c. electric stepper motor, a rotating differential transformer-resolver, a demodulator, and a digital absolute-displacement converter. Motor control and position-dependent switching are necessary, to ensure adequately high dynamic stability, for which various means such as inclusion of proportional-integral-differential regulation software in the microprocessor system are available. The coordinate transformer sends two currents in quadrature to the stepper motor through a current amplifier while receiving signals from an analog or digital processor of displacement signals. When operating with an analog processor, it also receives feedback from the converter. When operating with a digital processor, it also receives feedback from the demodulator while the current amplifier receives feedback from the converter. Both velocity and acceleration feedback is involved in ideal algorithmic, optimal or adaptive, displacement control. Figures 3; references 11: 10 Russian, 1 Western (in Russian translation).

**Analysis of Spatial Bistability in a System Under Optical Feedback**18600273d Moscow *IZVESTIYA VYSSHIKH**UCHEBNYKH ZAVEDENIY: RADIOFIZIKA**in Russian Vol 32 No 6, Jun 89, pp 715-721*

[Article by M. A. Vorontsov, D. V. Pruidze, V. I. Shmalgauzen]

[Abstract] This study carries out a spatial bistability analysis of a system in which the bistability results from spatial coupling of different points in a light beam. The optical scheme used in the analysis consists of a nonlinear Fizeau interferometer under optical feedback. A monochromatic, linearly-polarized lightwave is guided to the system entrance. The Fizeau interferometer consists of two plane-parallel glass plates coated with reflecting coatings. In this system an increase in light intensity was found to produce a space-time instability in the light field. The study carries out a theoretical analysis of optical bistability and spatial bistability in a first approximation. The analysis revealed that bistability was observed only when the intensity of the control light in the feedback loop exceeded a certain critical value. This conclusion was consistent with the theoretical analysis.

UDC 537.8

**Electromagnetic Characteristics of  
Current-Carrying Planar Networks With Ideal  
Conductors**

18600229a Kiev TEKHNIЧЕСКАЯ  
ELEKTRODINAMIKA in Russian No 2, Mar-Apr 89  
(manuscript received 13 May 88) pp 8-14

[Article by Yuriy Makarovich Vasetskiy, candidate of technical sciences, senior scientific associate, Institute of Electrodynamics, UkSSR Academy of Sciences, Kiev]

[Abstract] The two Maxwell field equations for the magnetic induction curl  $B$  equal to  $j$  and  $\text{div } B$  equal to 0 are solved for an alternating-current planar network of ideal conductors, assuming that the conductors are thin relative to the overall network dimensions and that the current frequency is sufficiently high for a strong skin effect with quasi-steady current flow in the surface layer only. The current density distribution in a conductor and the magnetic field distribution outside a conductor are calculated first considering the magnetic field of the surface current alone, without an external magnetic field and with a magnetic vector potential which satisfies the Poisson equation, then considering also a relatively weak external magnetic field. These calculations involve conformal mapping and lead to a line integral, only the longitudinal current component being relevant. The resulting approximate analytical relations are valid for planar networks of arbitrary configuration and on their basis can be calculated the inductance of such a network as well as the linear density of electromagnetic forces in it. Figures 1; references 11: Russian.

UDC 621.318.3.001.24

**Magnetic Fields in Two-Pole Magnetic Systems of  
Overhead Electromagnetic Iron Separators**

18600230a Novocherkassk IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY:  
ELEKTROMEKHANIKA in Russian No 3, Mar 89  
(manuscript received, after completion, 12 Oct 88)  
pp 12-20

[Article by Rafail Davidovich Smolkin, candidate of technical sciences, chief designer, and Oleg Petrovich Sayko, master designer, State Design Institute of Coal Dressing Machinery, Voroshilovgrad]

[Abstract] As the first step in design of overhead electromagnetic iron separators for extraction of incidental iron or steel objects from bulk material such as coal, calculations are made to determine the magnetic field intensity and then the electromagnetic ponderomotive force field in the active interpolar space of the two-pole magnetic system of such a machine. These calculations are based on the fundamental field equation which contains the Hamiltonian energy operator. Three methods of calculation are outlined, none of them requiring cumbersome

numerical analysis and solution of second-order non-linear ordinary differential equations of the separation process dynamics. In the first method, simplest but least reliable, the problem is reduced to a magnetic field between two infinitesimally thin plates in one plane with appropriate boundary conditions for the potential at their surfaces. In the second method the problem is reduced to a magnetic field between two infinitesimally thin plates at an angle without constraints on the field intensity at their surfaces. Both methods involve conformal mapping. In the third method, which uses the same equations as the second one, the two corner points of one pole shoe edge are shifted so that the actual length of both pole shoes will be replaced by their design length. The proper locations of these two points are found by mathematical simulation of the magnetic field with an electric current field on conductive paper. All three methods have been tested for accuracy against measurements in a redesign of P100M and P160M iron separators. Readings of the magnetic induction and of the electromagnetic ponderomotive force on a ferromagnetic ball in the interpolar space were converted, by each method of calculation, to the magnitude of magnetic field intensity  $H$  and to the product of  $H$  and its axial partial interpolar space derivative respectively. The redesign was successful, inasmuch as it raised the capacity of these machines by a factor of 1.6 with a better material and energy economy. Figures 4; tables 2; references 8: Russian.

**Traction Motor for an Electric Car**

18600255c ELEKTROTEKHNIKA in Russian No 6,  
Jun 89, pp 73-75

[Article by A. I. Bezsmertnyy, G. A. Gandzeychuk, V. A. Markov, I. I. Radimov, V. N. Slobodyanik]

[Abstract] This article focuses on the calculation, design, and performance of the 3DT66 traction motor for application to electric cars. The initial design calculation is a power-traction calculation intended to determine a range of mechanical and speed properties of the traction motor with two-range control which would provide the desired drive dynamics for an electric car with a minimum peak power drain from the storage batteries or a peak energy recovery level. The power-traction calculation yields a specific energy loss level of 255 W per second per meter for an electric car weight of 80 to 85 kg. The tests and calculations to determine the power performance of the traction motor for the case of a pulsed power supply yielded seven significant factors: the diameter and number of armature slots, the induction in the air gap, the armature heating factor, the current density in the pole windings, and the boost factor of the magnetic field in start-up and braking conditions. The optimum traction motor design was selected by varying these six factors. The study provides tables of the electrical brush dimensions, the winding wire sizes and the magnetization curves of both the electrical and structural steel components.

**The Electromagnetic Compatibility of Rail Circuits with Future Electric Power Rolling Stock**

18600256 Moscow AVTOMATIKA TELEMЕKHANIKA  
I SVYAZ in Russian No 6, Jun 89, pp 33-34

[Article by A. M. Kostrominov]

[Abstract] This article discusses the advantages of converting electric power rolling stock to thyristor control in order to guarantee electromagnetic compatibility between future electric power rolling stock and the rail power lines. The article also proposes using pulse-width control which in this application involves producing pulse power for the traction motors of the electric power rolling stock with a variable pulse width and a fixed frequency. A practical study of this design has indicated that using quartz generators for the electric power rolling stock in conjunction with pulse width thyristor control eliminates electromagnetic interference up to at least 100 to 200 Hz and clearly above 400 Hz. This would provide electromagnetic compatibility with the electric power rolling stock on the rail circuits operating at 25 and 50 Hz for the case where pulse width control is used.

**How to Improve the Operational Stability of RIS-V2 Radar Velocimeters**

18600269b Moscow AVTOMATIKA TELEMЕKHANIKA  
I SVYAZ in Russian No 7, Jul 89, pp 42-43

[Article by M. A. Smychek]

[Abstract] This article is a report on certain drawbacks of the RIS-V2 second-modification velocimeters tested on the Gorkiy-Sortirovochniy route of the Gorkiy Railroad during alignment, adjustment, installation, and operation. Certain circuit features of this unit cause the system to respond to sudden voltage spikes and yield imprecise voltage readings, thereby indicating an average speed of train sections rather than an accurate speed. In order to remedy this effect the article proposes using a trimmer resistor such as a 47-100 ohm SP5-2V resistor in place of the R26 fixed resistor. The trimmer resistor is attached to the velocimeter board so that direct access to its control is provided through a lateral hole. The proposed modification of the radar velocimeter makes it possible to rapidly and accurately regulate the new RIS-V2. The study also proposes two other modifications to improve the operating stability of the RIS-V2, one involving replacement of a previous 33 pf capacitor with a 200-220 pf capacitor, while the second modification concerns replacing the MLT-2 resistors with a 10-12 ohm resistor. This improves the functional reliability of the voltage converter.

### **X-Ray Computer Tomography in Industrial Diagnostics**

18600239c Moscow *PRIBORY I SISTEMY*  
*UPRAVLENIYA* in Russian No 5, May 89, pp 10-12

[Article by V. V. Klyuev, E. I. Vaynberg]

[Abstract] This is a survey article devoted to the history, general properties, and characteristics and capabilities of modern X-ray computer tomography for application to industrial manufacturing and diagnostics. The article discusses the development and manufacturing of base models of X-ray computer tomographs with a tomograph field diameter ranging from 25 mm to 1.2 m. These computer tomographs are different technical implementations of the same concept which includes local RF tomography and a tomograph reconstruction algorithm by backward projection followed by double differentiation filtering. The article provides numerous general and local X-ray tomographs of several materials including reinforced carbon composites, aluminum alloys, electrical motor and stator components, gas-turbine blades and ceramic parts used in gas-turbine and diesel motors. The article also discusses the anticipated progress in the field of X-ray tomography which includes improvements in the spatial resolution of the X-ray tomographs.

### **Primary Developmental Trends in Maritime Diagnostic Equipment**

18600239d Moscow *PRIBORY I SISTEMY*  
*UPRAVLENIYA* in Russian No 5, May 89, pp 14-16

[Article by S. N. Chirskov]

[Abstract] This article is devoted to an analysis of the primary concepts underlying existing maritime diagnostic techniques, equipment, and technologies. The article classifies the various diagnostic techniques used in oceanography, oceanic surveying and maritime prospecting. These include methods of determining spatial orientation, optical and sonar techniques, nondestructive monitoring and control methods, electrical diagnostic methods, microwave techniques, infrared scanning, X-ray diffraction and other radiography methods, vibrational diagnostics, etc. These techniques are classified in terms of their application to diagnostics and testing of facilities and structures in offshore oil platforms, underwater oil and gas pipelines, and other components and structures. The specific features and applications of the various techniques are discussed and compared.

### **Radiowave Nondestructive Testing Equipment**

18600239e Moscow *PRIBORY I SISTEMY*  
*UPRAVLENIYA* in Russian No 5, May 89, pp 21-23

[Article by V. I. Matveev]

[Abstract] This article examines the primary groups of radiowave nondestructive testing equipment based on

their functional application. The analysis focuses on the measurement of the thickness of component parts, dielectric coatings on metal, semiconductor films, etc. by means of microwave techniques as well as humidity measurements and both flaw detection and structural integrity testing. The instruments used for thickness measurements employ a microwave impedance technique used for thickness testing; such instruments also measure the electrical resistance of semiconductor, epitaxial and diffusion layers and structures. Humidity measurements are ordinarily carried out using instruments that measure the transmission of radiation through media or objects. Similar techniques are used in flaw detection and structural analysis. One common technique is the surface wave method which analyzes waves excited in coupled dielectric lines one of which is the test object while the other is an active dielectric antenna running in parallel. Block diagrams of several common nondestructive testing instruments are provided together with a comparison of their performance.

### **The Current State and Future Development of Medical Roentgenological Equipment**

18600239f Moscow *PRIBORY I SISTEMY*  
*UPRAVLENIYA* in Russian No 5, May 89, pp 36-37

[Article by F. R. Sosnin, L. V. Vladimirov, B. M. Kanter]

[Abstract] This article is devoted to current and future developments in medical X-ray instrumentation and ancillary equipment. Such developments as replacement of calcium-tungsten screens with rare-earth metal screens have made it possible to reduce radiation exposure by a factor of 3-4 and to reduce the danger of exposure by a like factor. Yttrium screens are finding increasing application in Roentgenological equipment while X-ray image amplifiers are used on an increasingly broad scale. The article also discusses the present state and future developments of ancillary equipment, including converters, power supplies, displays, and equipment shielding. Future improvements to medical roentgenological equipment will include enhanced contrast and resolution as well as an expanded exposure field and modernization of the automatic exposure systems. Future progress will also hinge on improvements to image quality by incorporating digital technology for storing and processing X-ray images.

### **Industrial Vision Systems for Diagnostics and Nondestructive Testing**

18600239g Moscow *PRIBORY I SISTEMY*  
*UPRAVLENIYA* in Russian No 5, May 89, pp 38-40

[Article by V. N. Koltsov]

[Abstract] This article analyzes industrial vision systems operating in the optical range for application to diagnostics and nondestructive testing. The article classifies the primary industrial vision systems (the OT-10MV, OT-10MP, URO, OT-10MT, OT-10MF, and OT-10PZSL)

in terms of operating parameters, including the type of light-to-signal converter, the number of sampling elements, the number of video signal quantization levels, the illumination range of the working area, output signal,

image conversion and input time to buffer, supply voltage, power consumption, dimensions, etc. The performance characteristics as well as the specific applications of the industrial vision systems are also discussed.

### **Evaluation of Interference Error Averaging Algorithms or an Amplitude Direction Finder**

18600214a Moscow *RADIOTEKHNIKA* in Russian  
No 4, Apr 89, pp 3-5

[Article by B. G. Barabashov, O. Yu. Pelevin]

[Abstract] This study determines the interference error of an amplitude direction finder for the case of signal peak direction finding and estimates the effectiveness of three statistical processing algorithms for reducing the effect of multipath propagation with complex (simultaneous phase and amplitude) feeding. The three statistical processing algorithms proposed in the article include a linear averaging algorithm, an averaging algorithm with a weight proportional to the signal amplitude and an averaging algorithm where signal power is used as the weight coefficients. The analysis reveals that statistical averaging of the bearing is an effective means of reducing the interference error of an amplitude direction finder in the complex feeding case. The study determines that linear averaging is the simplest and most suitable technique to suppress discrete ionospheric multipath propagation and is useful for determining the azimuth of the dominant beam.

### **Estimation of the Mutual Effect of Polarization-Orthogonal Channels in Ionospheric Signal Propagation**

18600214b Moscow *RADIOTEKHNIKA* in Russian  
No 4, Apr 89, pp 6-7

[Article by G. N. Aninchenko, A. D. Kononov]

[Abstract] This study investigates the mutual effect of polarization-orthogonal channels caused by the polarization transformation of ionospheric radio signals. This signal depolarization effect is estimated quantitatively by the ratio  $S-N$  which represents the ratio of the power delivered to a matched load to the channel of the signal power received by the same antenna with orthogonal radiation polarization for each of the orthogonal channels. The analysis reveals that the mutual effect of channels with orthogonally-circular polarization averages 15 to 20 dB lower compared to channels with linear orthogonal-polarized signals for an actual depolarizing ionospheric channel within a frequency band allowing radiowave propagation at a given electron concentration and propagation route geometry.

### **Radar Reflectance of the Venusian Terrestrial Surfaced from Venera-15, -16 Spacecraft Data**

18600214d Moscow *RADIOTEKHNIKA* in Russian  
No 4, Apr 89, pp 12-16

[Article by A. V. Abramov, A. V. Grechishchev, N. V., Zherikhin, I. A. Zheltikov, G. M. Levchenko, A. A. Morozov]

[Abstract] This article reports radar reflectance data for the Venusian terrestrial surface recovered from the side-looking

radar and radio altimeter instruments on board the Venera-15 and -16 spacecraft. The results were obtained at an 8 cm wavelength and covered the northern polar region of the Venusian surface not previously imaged. The article also provides AGC maps for the side-looking radar and radio altimeter channels covering the Venusian terrestrial surface above 30° northern latitude. Such maps were used as the raw data for producing digital maps of the radar reflectance of the terrestrial surface of the planet.

### **Application of an Autoregressive Spectral Analysis to the Radar Detection of Sea Surface Slicks**

18600226f Gorkiy *IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA* in Russian  
Vol 32 No 4, Apr 89, pp 521-523

[Article by M. B. Kanevskiy]

[Abstract] This study demonstrates by numerical modeling that an autoregressive spectral analysis can be used effectively to detect irregularities of even a nonquasiperiodic type: isolated sea surface slicks. The analysis focuses on the case of a pulsed noncoherent centimeter wavelength band radar on a vessel traveling at a velocity  $V$  probing the sea surface at a grazing angle of 10 to 70° thereby satisfying the resonance scattering conditions without shadowing. The study analyzes a sequence of noncorrelated amplitudes of echo pulses from a section of length  $L$  consisting of  $n = L/V\tau$  terms where  $\tau$  is the correlation time of the fast amplitude fluctuations produced by orbital motion of the scatterers. The mathematical model developed for the autoregressive spectral analysis is based on such a case and incorporates one additional modulating factor to account for sea surface slicks. The analysis considers two possible background types, a homogeneous background and an inhomogeneous background with the background inhomogeneities described by this same factor and differing only in the value of a single parameter. The analysis suggests that noise is a fundamental factor in the autoregressive spectral analysis. Preliminary numerical experiments for a sinusoid of a single period length for the case of multiplicative Rayleigh noise demonstrated that partial smoothing of the radar signal served to increase the accuracy of the autoregression estimate: fluctuations of the spectral maximum were reduced. The study also develops an algorithm for calculation of the autoregressive spectral estimate. This algorithm is used in the model calculations. Curves based on 500 signal implementations are drafted to represent the probability of the model statistics exceeding a given threshold with the parameter representing a characteristic of the slick level. The subsequent analysis focuses on classifying situations corresponding to different values of the slick level. It is determined that the sequence of the autoregressive process is a substantial factor in the detection process.



UDC 621.396.96

**Rejection Comb Filtering of Polarization-Keyed Radar Signals**

18600243a Kiev IZVESTIYA VYSSHIKH UCHEVNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 32 No 5, May 89 (manuscript received, after revision, 8 Feb 88) pp 3-8

[Article by V.N. Tatarinov, S.P. Lukyanov, and Ye.V. Masalov]

[Abstract] Radar measurement of the anisotropy of scattering objects such as hydrometeors using polarization-keyed signals with interperiodic compensation is analyzed, specifically linear-circular polarization keying and a logarithmic receiver for such signals being considered for this purpose. The spectrum of the pulse sequence at the receiver output is regarded as a superposition of two non-modulated pulse sequences with different amplitudes, their repetition period being the same and the two shifted in time by half that repetition period. The spectrum of the resultant sequence at the receiver output is found to be that of a sequence at the output of a rejection comb filter, which has been confirmed experimentally. Figures 3; tables 1; references 6; Russian.

UDC 621.396.964

**Simultaneous Estimation of Space Parameters of Signal From Long Object**

18600243b Kiev IZVESTIYA VYSSHIKH UCHEVNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 32 No 5, May 89 (manuscript received, after revision, 29 Mar 88) pp 12-17

[Article by A.N. Yuryev]

[Abstract] Simultaneous statistical estimation of space parameters of a signal either emitted or reflected by a long object is analyzed for feasibility of resolving the set of parameters and measuring each. Simultaneous estimates of the linear shift and the space-frequency shift are shown to be interdependent, whether the object is located in the near field or in the far field. Simultaneous and separate estimates are compared analytically with respect to resulting measurement accuracy, using to versions of a function which characterizes the output of the space processing system. Figures 4; tables 1; references 3; Russian.

UDC 621.391.173

**Interference Immunity of Noisy Anticorrelation Radar Systems**

18600243c Kiev IZVESTIYA VYSSHIKH UCHEVNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 32 No 5, May 89 (manuscript received 3 Feb 88) pp 75-77

[Article by Yu.V. Fedotov]

[Abstract] A noisy radar system with an anticorrelation scheme is analyzed for interference immunity, such a radar system having been recommended on account of high measurement accuracy but only in the absence of interference. The anti-correlator processes an additive mixture of received signal, leakage and interference signal, and reference signal taken out of the transmitted signal, whereupon a subtractor puts out a difference signal which is squared and then integrated in a low-pass filter. The results of this analysis indicate that an active noise interference destabilizes an anticorrelation radar system much more than a correlation radar system which realizes its potential interference immunity. References 4: 3 Russian, 1 Western.

UDC 535.243.1:632.2

**Information Content of Readings Taken in Remote Measurements by Polarization Method for Estimating Condition of Crops**

18600266a Minsk DOKLADY AKADEMII NAUK BSSR in Russian Vol 33 No 7, Jul 89 (manuscript received 22 Jun 88) pp 610-613

[Article by Ye. A. Yanovskaya and A. F. Yanovskiy, Institute of Physics, BSSR Academy of Sciences]

[Abstract] Information about the condition of plant crops is shown to be extractable from readings taken in remote measurements by the radiation polarization method, following a theoretical analysis of reflection data on the basis of Fresnel reflection coefficients for specular reflection with angle-dependent degree of linear polarization and for diffuse scattering of some incident radiation. Data on reflection by foliage of cotton plants, obtained by measurements over 7-8 h and 12-13 h periods in cloudless and windless weather with instrumentation including an elevation meter and a compass, have been tested for accuracy of this method of measurement in statistical terms. Their interpretation on the basis of the Fresnel model and a biparametric distribution indicates that changes in both reflection coefficient and degree of polarization are caused not only by heliotropic growth but also by development of disease. Article was presented by Academician L. I. Kiselevskiy, BSSR Academy of Sciences. Figures 2; references 6: 3 Russian, 3 Western.

### Magnetic Tapes: Technical Characteristics

18600245c Moscow RADIO in Russian No 5, May 89  
pp 50-54

[Article by Yu. Vasilevskiy and A. Zlobopolskiy]

[Abstract] Eight grades of magnetic tape according to Government Standard 17204-71 are evaluated in terms of technical characteristics which determine their suitability for sound recording and playback, these grades including type I (iron oxide), type II (chromium dioxide), type III (iron oxide plus chromium dioxide), and type IV (metallic iron powder). The key properties of the active tape material are its coercive force and optimum magnetizing current, two important tape design parameters being thickness of substrate and thickness of active layer. Essential performance characteristics are sensitivity, frequency characteristic, third-harmonic ripple, maximum operating level, playback-gap noise level, magnetization noise level, overprint level, and erasure level, all relative to the nominal recording level at the reference frequency. Essential mechanical characteristics are tensile strength, yield point, percentage elongation, edge curvature, warpage, and abrasiveness. Depending on their characteristics, these tapes are used either in reel recorders or in cassette recorders.

UDC 621.3.049.772:665.226.221

### Cleaning of Dielectric Substrates Prior to Vacuum Deposition of Films

18600260b Moscow PRIBORY I SISTEMY  
UPRAVLENIYA in Russian No 4, Apr 89 pp 34-35

[Article by I. G. Shchurova, candidate of technical sciences, V. N. Gusev, candidate of chemical sciences, and N. P. Kosmodemyanskaya, engineer, Scientific-Industrial Association 'Elektronpribor' (Electron Devices), Yaroslavl]

[Abstract] A new surfactant has been developed for chemical cleaning of glass-ceramic substrates prior to vacuum deposition of films. It is based on an aqueous solution of sulfo salts which dissolves many organic contaminants, with complex forming agents added which wash away most contaminating cations. Treatment with this surfactant in a vibrator does not degrade the substrate surface. The optimum temperature range for this treatment is 50-70 deg C, the cleaning process being completed within 5-20 min. Figures 2; references 5: Russian.

UDC 621.3.049.772.2.001.18

### Method of Predicting Yield of Acceptable Printed-Circuit Boards in Production of Thick-Film Microcircuits

18600263b Moscow PRIBORY I SISTEMY  
UPRAVLENIYA in Russian No 6, Jun 89 pp 35-37

[Article by S. A. Belousov, engineer]

[Abstract] A method of predicting the yield of acceptable printed-circuit boards in production of thick-film integrated

microcircuits is proposed, such a production usually involving boards of one type but with up to four different nominal values of resistance. The method is based on resistance measurements but, unlike the conventional method, with the readings presented in the form of ratio  $R/R_n$  ( $R$ - resistance of inspected board,  $R_n$ - nominal resistance corresponding to a given grade of resist paste and equal to surface resistivity of the resist paste times number of resist squares on inspected board). The center and the standard deviation of a normal distribution are calculated in accordance with probability theory, this distribution then being compared with the tolerance range of resistance values. Maximum yield of acceptable boards corresponds to coincidence of the center of the normal distribution with the center of the tolerance range. Subsequent prediction of the yield is facilitated by use of a special function, namely the probability integral, for the manufacturing allowance and for the lowest of permissible upper bounds of deviation from nominal resistance. The "3 sigma" rule is applicable here, the possibility of boards having resistances whose probability is less than 0.003 being disregarded so that the yield of acceptable ones can be 0.997 under optimum conditions. Figures 2; tables 2.

UDC 628.93(083.74)

### Departmental Construction Code VSN 59-88: Electrical Equipment for Residential and Public Buildings. Design Specifications

18600265a Moscow SVETOTEKHNIKA in Russian  
No 7, Jul 89 pp 1-18

[Abstract] This concluding second part of the article outlining the design specification for electrical equipment in residential and public buildings in accordance with the 15 sections of Departmental Construction Code VSN 59-88 (first part in SVETOTEKHNIKA No 6, Jun 89 covered the first 4 sections) covers the remaining 11 sections. These are: 5) layout of electric circuits (criteria: simplicity, reliability, economy); 6) power distribution schemes; 7) group circuits on one phase, on two or three phases, depending on length of lines and magnitude of load; 8) lighting control; 9) protection of indoor circuits against voltage surges of up to 1 kV and selection of conductor sizes; 10) short-circuit currents; 11) lead-in distributing equipment, main distribution panels, individual distribution panels, junction boxes, and nameplates; 12) installation of indoor circuits; 13) electric heating and hot water supply; 14) meters for accounting and billing; 15) grounding or connection to neutral and safety provisions. Mandatory specifications for lighting in theatres and in 15 types of medical facilities have been developed by the State Institute for Planning Theatrical Entertainment Houses at the USSR Ministry of Culture and by the State Scientific Research and Planning Institute of Health at the USSR Ministry of Health Protection respectively. Formulas are recommended as guide to selection of protective devices for lighting and power networks in buildings. Tables 6.

UDC 621.327

**Selection of Light Sources for Industrial Lighting With Regard to Energy Saving***18600265b Moscow SVETOTEKHNIKA in Russian No 7, Jul 89 pp 18-22*

[Article by L. S. Guseva, engineer, and M. A. Fayermark, candidate of technical sciences, All-Union Institute of Illumination Engineering]

[Abstract] Selection of light sources for industrial lighting from among available incandescent and discharge lamps is considered from the standpoint of energy saving, with specific installed lighting power and normalized annual cost of lighting equipment as the principal two criteria. The concept of lighting sets which meet all specifications at minimum levels of either one criterion or both is introduced, such sets meant to serve as reference standards. The selection problem is then solved with the aid of technical and economic performance data on several mass-produced types of lamps and luminaires, these data being organized into ranges on the illumination-distance (lux-meter) diagram. Figures 3; tables 2; references: 9 Russian.

**The Possibility for Local Internal Human Organ Heating by a Series of Radio Pulses***18600273c Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 32 No 6, Jun 89, pp 701-705*

[Article by V. D. Sakhatskiy, V. F. Pavlov]

[Abstract] This study examines the possibility of using a series of radio pulses to induce local heating of internal human organs. The underlying assumption in this approach is that radio pulses at different carrier frequencies can be induced in pulse trains, and the different absorption properties of the human body and the varying propagation times of the pulses will create areas where the secondary and primary pulses will meet, thereby producing local heating of internal human organs. The primary and secondary radio pulse frequencies used in this experiment were 100 MHz and 3000 MHz. Calculation results are provided for the spatial distribution of the total radio pulse field strength at various times. The results indicate that the secondary pulse, which travels through the body at a higher propagation velocity, catches the primary pulse at a specific depth in the body. The total field amplitude therefore reaches a peak in this area and its magnitude will always exceed that achieved by individual transmission of isolated pulses. The technique therefore proved effective for initiating internal local heating of human organs.

**Calculation of a Square Waveguide Polarizer**

18600160i IZVESTIYA VYSSHIKH UCHEBNYKH  
ZAVEDENIY: RADIOELEKTRONIKA in Russian  
Vol 32 No 2, Feb 89, pp 91- 92

[Article by L. V. Skrypnik, V. N. Pochernyaev, S. V. Mirnyy]

[Abstract] This article examines a method of analyzing and fabricating a square waveguide polarizer. The principle of operation of the polarizer is as follows. The electrical field vector of the  $H_{10}$  mode of the square waveguide is represented as a superposition of two perpendicular vectors: perpendicular to and parallel to the metallic plates. The critical wavelength of these field

components is different and hence a phase shift occurs between the two orthogonal waves during propagation along the polarizer. In order to calculate the performance of such a polarizer this article determines the critical wavelengths. Two cases were considered for determining the critical wavelengths of the two orthogonal fields. In the first case the metallic plates were perpendicular to the electrical field while in the second case the metallic plates were parallel to the electrical field. Computer calculations indicated a critical wavelength of  $1.882a$  and the calculation results were used to fabricate a polarizer operating at 7.8 GHz with the geometric dimensions  $b = 3.5$  mm,  $l = 1.37$  mm and  $a = 28$  mm. The measurement results are consistent with calculation and show the broad operational range of the polarizer.

**The Design of Municipal Telephone Networks***18600272a Moscow VESTNIK SVYAZI in Russian  
No 7, Sep 89, pp 20-22*

[Article by I. A. Pugachev]

[Abstract] This article is a survey of a lecture series called "Pugachev's Thirteen Postulates" which presents a modern approach to network design and cost effective design solutions. The thirteen postulates are as follows. 1) The most important condition in developing a telephone network plan is a well-established design for the development of the municipal telephone network. 2) The cable network must be constructed within its own region in developing a construction design for a specific regional exchange. 3) PSK-1000 portable subexchanges should be installed at cost-effective distances in remote regions serviced by automatic telephone exchanges. 4) The approach to determining the specifications on telephone call density must be differentiated based on distances to the automatic telephone exchanges. 5) If the area serviced by the automatic telephone exchange under design already contains line facilities these must be used to the maximum possible extent. 6) Ferrous metal supplies must be conserved to the greatest extent possible. 7) As the telephone call density increases it is necessary to gradually convert from the traditional distribution-bay-based design of municipal telephone networks to designs eliminating such distribution bays. 8) It is important to attempt to expand existing cables and avoid parallel running of low-capacity cables which reduces the utility of the underground cable system. 9) It is important to determine the optimum scale of underground telephone cable route construction. 10) Substantial savings can be achieved by optimum distribution of underground telephone cable ducts on the cable network. 11) Reinforced cable must be used underground and overhead lines must be constructed in undeveloped areas and in regions containing buildings of few floors. 12) It is important to use, to the greatest possible extent, the existing capabilities of construction organizations, other ministries, and departments. 13) It is important to cooperate with Grazhdanproekt in order to implement their decisions regarding the construction of telephone cable ducts and cable laying to account for the future development of the municipal telephone network.

**Modifying Equipment Ordering Procedures***18600272b Moscow VESTNIK SVYAZI in Russian  
No 7, Sep 89, pp 31-33*

[Article by V. I. Zakharov, T. A. Borodulina]

[Abstract] This article discusses the difficulties of relying on designers to determine their material and product requirements for specified future periods in the communications equipment manufacturing industry. The article claims that the situation has worsened since the introduction of self-financing whereby some of the equipment needed to manufacture products for communications systems and to maintain their operation have not met the needs of the enterprise staffs and they have stopped acquiring such equipment. Experience in this area suggests that many issues in network

development cannot be handled by communications enterprises. The article proposes several conditions that must be satisfied in order to substantially improve the reliability of demand requirements. Such measures include the following steps: 1) the main administrations of the division in conjunction with the republic Ministries of Communications and Operating Enterprises must develop and adopt a communications development design relative to their areas; 2) the Main Scientific and Technical Administration of the USSR Ministry of Communications must analyze and coordinate the various designs of the different branch main administrations and; 3) the norms and standards for outfitting various equipment and systems used at communications facilities, stations, exchanges, etc. are then determined based on the approved development designs for the communications industry for the next ten and twenty years.

**Development of Communications Networks Through the Year 2005***18600272c Moscow VESTNIK SVYAZI in Russian  
No 7, Sep 89, pp 38-40*

[Article by S. I. Belov, N. V. Volchkova]

[Abstract] This article is devoted to a review of the future development of communications facilities in the USSR, including telephone and telegraph networks, television and radio broadcasting, wire broadcasting, etc. within the scope of the "Plan for the Development and Distribution of Nationwide Communications Facilities in the USSR Through the Year 2005." This plan calls for the uniform installation of telephones in municipal apartments with a substantial satisfaction of demand for local telephone network services in rural areas (6 telephones for every ten families) by the year 2000. The plan also outlines designs for the future development of telegraph communications accounting for the increase in population and improvements in services. The expansion of the television network through the year 2005 will involve providing multiple program access to the entire population and improving the quality of television transmission stations. Improvements in wire broadcasting are also planned. The number of radio broadcasting stations in this service will reach nearly 92 million by the end of the planned period. Multiprogram broadcasting is planned in this area for rural audiences as well.

**Fiber-Optic Communications Links on the Minsk Municipal Telephone Network***18600272e Moscow VESTNIK SVYAZI in Russian  
No 7, Sep 89, pp 47-50*

[Article by V. M. Baydak, V. F. Mishkin, L. Ye. Polyakov]

[Abstract] This article discusses the various aspects of the design, installation, operation, maintenance, and trouble-shooting of fiber-optic communications links on the Minsk municipal telephone network. The procedures and equipment used in the acceptance testing of OK50-2-5-8 and OZKG-1-1.5-4/4/27 optical cables for use on the network are described together with the techniques

used to install (lay) optical cables in underground cable ducts, the installation, wiring, and soldering of optical fiber couplers and the maintenance testing of the systems. The wiring diagrams for measuring attenuation on these links are provided together with standard acceptable attenuation levels measured by different techniques. Suggestions are given for optimum installation of fiberoptic cables for use in municipal telephone networks.

**Final Acts Adopted by the World Administrative Radio Conference on the Use of Geostationary Satellite Orbit and the Planning of Space Services**

*18600236a Moscow ELEKTROSVYAZ in Russian  
No 5, May 89, pp 8-11*

[Article by A. L. Badalov, L. Ya. Kantor]

[Abstract] This article reports the proceedings of the Second Session of the WARC on the use of geostationary satellite orbit and the planning of space services held in 1988. The primary purpose of this conference was to implement plans for access to geostationary orbit and frequency bands assigned to fixed satellite services accounting for the requirements of the developing nations and specific geographical conditions. In addition to the primary plan the Conference also considered several other procedures, including the administrative procedure for frequency assignment, logging routine, the procedure for forming subregional systems using one or several spacecraft and the procedure for establishing secondary systems within the planned frequency band as well as the procedure for including new frequency assignments for new members of the World Administrative Radio Conference. Other adopted resolutions included WARC-ORB-88 on procedural issues and resolutions WARC-ORB-88 on the satellite radio broadcasting service.

**"Intersputnik": A Space Bridge of Friendship**

*18600236b Moscow ELEKTROSVYAZ in Russian  
No 5, May 89, pp 12*

[Article by Manuel Rabassa]

[Abstract] This article is a general discussion of the existing "Intersputnik" system which currently uses two spacecraft - "Statsionar-4" ("Stationary-4") (14° Western longitude) and "Statsionar-13" ("Stationary-13") (80 Eastern longitude) - as well as 22 Earth stations in the member-nations of the "Intersputnik" system. Cuba's utilization of the Intersputnik system and its role in the network are discussed. "Statsionar-4" is used by Cuba for both uplink and downlink transmissions and currently carries "Cubavision", the national television programming network. The article also briefly discusses the Twenty-Sixth Session of the "Intersputnik" organizational council which was held in October of 1988 in the small Cuban village of Topez de Calantes. The future of "Intersputnik" through the year 2000 was discussed at this conference. The primary strategy for the future evolution of the network includes expanding services, adopting new frequency bands, and increasing the

throughput capacity of the spacecraft, reducing the size and cost of Earth stations, incorporating microprocessor technology and using satellites to establish both regional and national communications.

**Swiss Telecommunications Engineering in Moscow**

*18600236c Moscow ELEKTROSVYAZ in Russian  
No 5, May 89, p 15*

[Article by R. Lvov]

[Abstract] This article discusses a symposium devoted to Swiss telecommunications equipment that was held in Moscow in late 1988. This symposium was sponsored by the Swiss commercial telecommunications association "Swisscom" and was held at the Center of International Trade and Scientific and Technical Communications. The Swiss companies "Autelca" and "Gfeller" participated in the symposium and the small exhibition sponsored by the same group. The "Telca Star" pay telephone manufactured by Autelca which is a credit-card operated pay telephone attracted the most attention. This pay telephone is equipped with a keypad, an ongoing credit and number-dialed readout, and both audio and visual credit card readout. Other equipment included the ELD-96 subscriber concentrator for 32, 48, 64, or 98 subscriber lines operating into a maximum of 16 trunks.

**Scientific Research Instruments**

*18600236d Moscow ELEKTROSVYAZ in Russian  
No 5, May 89, pp 16-17*

[Article by L. Marinin]

[Abstract] This article reports the proceedings and display at the Fourth International Exhibition "Science-88" (Nauka-88) held in late 1988 in Moscow. Two hundred seventy eight Soviet organizations and enterprises and more than 600 foreign companies from 25 nations participated in the exhibition. The Soviet equipment shown at the exhibition included a broad range of scientific and engineering instruments including the VOLS-A-1 analog fiber-optic communications line which was exhibited by the Institute of Radio Engineering and Electronics of the USSR Academy of Sciences. This fiber-optic line is designed for analog signal transmission in powerful electromagnetic fields. Another Soviet exhibit contained the KVI-0406 and KVI-0203 waveguides used to test microwave equipment and employed in physics research in the millimeter wavelength band. Companies from the Federal Republic of Germany, Austria, and Japan had the largest foreign exhibits. Rohde und Schwarz (the FDR) exhibited two new instruments: the EB-100, a compact 20-1000 MHz receiver and an LAL logic analyzer for alignment and repair of digital equipment. The Indian company Essen Telecommunications EVP Ltd. exhibited the SN-EPABX commercial automatic telephone exchange designed for 16 trunks and 64 telephones.



# **The Interrelationship of Digital Radio Broadcast Network Planning Parameters**

*18600236e Moscow ELEKTROSVYAZ in Russian No 5, May 89, pp 18-20*

[Article by M. V. Gitlits, A. Yu. Zelenin, O. B. Popov]

[Abstract] This article focuses on possible designs of a ground-based VHF digital radio broadcasting network. Each possible design configuration contains several possibilities for practical implementation of the network and guarantees a specific sound quality at given signal-to-noise and signal-to-interference ratios at the receiver input. A simulation model of a digital phase-difference modulation tuner was used to draft the dependences of the probability of error reception characterizing the noise immunity of the tuner as a function of the signal-to-interference ratio for different signal-to-noise ratios. The analysis also incorporates the requirements for the protection ratio. The quantitative estimates of the signal-to-interference ratio derived in the study are used to both formulate requirements on the digital radio broadcasting system for VHF networks employing few frequencies and for preliminary frequency assignment in an experimental broadcasting region. The study also concludes that the safety factor must have a range sufficient to account for signal fading in order to eliminate the threshold effects characteristic of digital radio broadcasting systems. The calculations must also account for the signal-to-noise ratio.

## **Ultralongrange Oversea Propagation of VHF, UHF, and SHF Radiowaves**

*18600236f Moscow ELEKTROSVYAZ in Russian No 5, May 89, pp 23-27*

[Article by V. N. Troitskiy, Yu. I. Petrushko, B. P. Mesherskiy, R. Vlahova, V. Ivanov, N. Mollov, I. Nikolov]

[Abstract] This study reports tests conducted to recover statistical data on oversea VHF, UHF, and SHF radiowave

propagation on the Michurin (People's Republic of Bulgaria) - Golovink (USSR) route between 1982 and 1983 at 821 MHz. The same route was used in 1986 to obtain data on the frequency dependence of the signal and the statistical mechanisms of anomalous signal propagation over a broad frequency range. These experiments revealed that the signal levels in ultralongrange propagation over the Black Sea substantially exceed those predicted by Report 569-3 and CCITT Recommendation 370-5. The attenuation factor for anomalous ultralongrange oversea propagation of VHF signals has an unusual frequency dependence with the maximum lying in the UHF range and diminishing in the VHF and SHF ranges. Further, an analysis of the statistical properties of the signals indicates that the four-month observation period is insufficient to obtain reliable data on the probability of anomalously high signal levels.

## **VHF Radiowave Propagation Over Warm Water**

*18600236g Moscow ELEKTROSVYAZ in Russian No 5, May 89, pp 27-29*

[Article by A. A. Shur, B. F. Melnikov]

[Abstract] This study reports tests conducted on VHF radiowave propagation over the Black Sea intended to test the suitability of CCITT Recommendation 3370-5. These tests carried out extended measurements of signal field strengths on Over The Horizon routes and investigated its dependence on the height of the receive antenna. The Trabzon-Sochi route was used for tests at 92 MHz, while the Samsun-Sochi route was used for measurements at 90.8 MHz. The tests were conducted year-round in long-term (a few hundred hours) sessions. Analysis of these data suggest that the VHF signal strengths exceeded the levels recommended by CCITT Recommendation 3370-5 for the entire observation period on oversea radio routes in the Black Sea region. This indicates that it is necessary to introduce an average correction of 10 dB on signal strength levels for planning communications networks in this region.

### **Diagnostics of Power Generating Equipment**

*18600253b Moscow ELEKTRICHESKIYE STANTSII in Russian No 6, Jun 89, pp 49-51*

[Article by Ya. D. Berkovich]

[Abstract] This study discusses the present functional diagnostic and routine testing procedures used on turbine-generator units in industrial practice. The study reports the steps and procedures used in diagnostic testing of a K-200-130 turbine generator unit. Standard diagnostics revealed a narrowing of the through section in the vicinity of the 13th through 15th stages of the turbine blade section. Ordinarily the turbine is broken down to examine the condition of this area although a different method was used here. Based on an analysis of the design documentation on the turbine it was decided to inspect the vapor inlet region where the steam is injected through an aperture in the guide apparatus after the control valves. The endoscope inspection showed that the trailing edges of the guide blades had failed. The article recommends on this basis adding inspection of the trailing edges of the blades to the diagnostic procedure for turbine-generating units.

### **Certain Aspects of Short-Term Credit for Operating Atomic Power Plants in the New Economic Conditions**

*18600253a Moscow ELEKTRICHESKIYE STANTSII in Russian No 6, Jun 89, pp 6-7*

[Article by A. V. Pasko]

[Abstract] This article discusses the various aspects of financial and bank credit support for atomic power plants in the light of new economic conditions in the Soviet Union. The special operational aspects of atomic power plants are also discussed, including the fact that the cost of reactor fuel cannot be immediately written off to electricity costs, since it is not immediately utilized. The nuclear fuel firing process is a long-term procedure. Atomic power plants therefore have a so-called long-term transient operating mode. The study proposes that planned excess working capital for atomic power production be calculated using a special technique that accounts for these aspects of nuclear electricity production. The article also recommends establishing lines of credit for atomic power plants whereby periods of overproduction are used to cover operating costs in periods of under production.

### **The Current State and Prospects for the Development of 1000 kV a.c. Power Transmission Abroad**

*18600254b Moscow ELEKTRICHESTVO in Russian No 6, Jun 89, pp 9-15*

[Article by V. V. Ilinichnin, I. I. Kartashev, V. A. Mirolyubov]

[Abstract] This article discusses the current state and future development of a.c. power transmission at levels exceeding 1000 kV in the western nations. Power plants under construction in a number of countries are detailed, including Italy, Japan, Brazil, the US, and the People's Republic of China. The physical plant equipment used in the power generating facilities and to support power transmission over transmission lines are also discussed, specifically: voltage surge protectors, 6000/1 A current transformers, 1050/0.1 kV voltage transformers, power transformers, substation designs, cables, etc. Power transmission line equipment is also discussed including towers, insulators, spacing of towers, etc. The study concludes that most technical problems in the field of power generation and transmission have already been solved. The primary remaining problem is constructing sufficient power generating capacity to meet future increasing demand.

### **The Principles of Planning Service Life Tests on High Voltage Cable Insulation**

*18600254c Moscow ELEKTRICHESTVO in Russian No 6, Jun 89, pp 66-69*

[Article by S. Ye. Gleyzer, M. Yu. Shuvalov]

[Abstract] This article discusses the principles of service-life testing of high-voltage cable insulation. Such principles are designed to include a wide range of testing procedures for high voltage cable, including research aimed at refining quantitative parameters as well as mathematical models reflecting cable aging and failure, final adjustment tests carried out during cable manufacturing and standard tests to determine the service life of restored cable and compare such service lives to those outlined by the technical specifications. The high-voltage cables covered in this analysis include oil-impregnated, plastic-insulated, and gas cables. The study also provides equations for use in developing a model of cable aging, damage, breakdown and failures from a variety of causes. A number of graphs are provided for evaluating the long-term service life and performance of the various cable models in a variety of operating conditions and under different loads.

UDC 621.843.355

**Characteristics of Vision Under Threshold Conditions***18600204a Moscow SVETOTEKHNIKA in Russian  
No 4, Apr 89 pp 6-9*

[Article by D. N. Lazarev, doctor of technical sciences]

[Abstract] Characteristics of vision under threshold conditions are evaluated, namely the dependence of the threshold contrast on the luminance of the object and on the background luminance as well as on the angular dimension of the object, on the length of observation or exposure time, and on the probability of correct discrimination. The evaluation is based on experimental data according to H. R. Blackwell (JOSA, 1946), also earlier and later ones including IES-1981 data, they having been reprocessed from tables into a log-log "standard" graphical format for comprehensive correlation. The data pertaining to 1-15 s long observation or exposure time need to be refined and no measurements have been made for virtually infinite lengths of time. The author thanks Professor A. V. Luizov for consultations and valuable comments. Figures 7; tables 5; references 11: 7 Russian, 4 Western.

UDC 628.977.1

**Prospects of Using Microprocessors for Control of Industrial Lighting***18600204b Moscow SVETOTEKHNIKA in Russian  
No 4, Apr 89 pp 9-10*

[Article by Y. A. Kungs, candidate of technical sciences, and B. A. Oshchepkov, candidate of technical sciences, Siberian Regional Management of Power System for Nonferrous Metals Industry]

[Abstract] Use of microprocessors for technically and economically optimal complex control of industrial lighting in large plants is considered, lighting now being controlled simply by means of photoelectric and time relays. For this are needed first a lighting network with a diversified structure adaptable to different illumination requirements in different locations within the system, then a microprocessing unit compatible with output signals from illuminance transducers and timers. Needed are also controllable contactless voltage commutating and regulating devices, communication channels, interfaces, and flexibility for program changes by operator intervention. Two possible variants of a microprocessor control system are compared. The first one is based on a mathematical model, with corrections of indoor illumination made by a photoelectric scanner of light sensors. The second one is based on input from monitoring photoelectric transducers covering the entire plant area, with time correction only. Most suitable for either variant of lighting control are the Elektronika MS-2702 programmable controller with storage and series PPTT-220-63 semiconductor triode-transistor converters. References 9: 8 Russian, 1 Western.

UDC 621.327.7:535.037

**Emission Characteristics of Nanosecond Flash Lamps***18600204c Moscow SVETOTEKHNIKA in Russian  
No 4, Apr 89 pp 12-13*

[Article by Ye. S. Voropay, candidate of physical and mathematical sciences, F. A. Yermelitskiy, candidate of physical and mathematical sciences, and V. A. Shevtsove, engineer, Institute of Application Problems in Physics imeni A. N. Sevchenko, Minsk]

[Abstract] The emission spectra of nanosecond flash lamps are analyzed, these lamps containing air and nitrogen under a pressure of 0.1 MPa and their cathode is made of either thoriated tungsten or steel. Measurements made with Ramalog-4 and KSVU-23 high-resolution spectrometers reveal highest intensity peaks within the near-ultraviolet 290-400 nm range at the wavelengths of  $2^{plus}N_2$  and  $1^{plus}N_2$  lines, much lower intensity peaks within the visible-and-infrared range at the wavelengths of  $1^{plus}N_2$  lines with wideband 420-800 nm background light attributable to diffusion most likely caused by chemoluminescence during the NO plus O reaction in air. Injection of more nitrogen intensifies most visible and infrared lines only, because N-atoms quench the metastable  $A_2Sigma_{plus}$  state of  $N_2$ -molecules. Inasmuch as different mechanisms govern excitation and deexcitation of corresponding energy levels, the duration of flashes varies depending on the wavelength of emitted light. Flashes of light within the 290-400 nm range can be 2 ns long and flashes of light within the 600-850 nm range can be 4.8 ns long, addition of  $N_2$ -molecules lowering the concentration of N atoms and thus weakening the quenching effect of the latter. Another characteristic of these flash lamps is polarization of light, by action of the envelope glass, the degree of polarization in the direction of discharge reaching 0.5 and remaining the same within the band of each electronic-vibrational transition. An exception is the 430-550 nm band, which corresponds to transitions in which levels become populated by cascade processes. Figures 1; references 5: 4 Russian, 1 Western.

UDC 628.975.5.392:(628.94:621.3.019.3)

**Criteria for and Methods of Estimating Reliability of Schemes of Connecting Airfield Runway Lights to Electric Power Supply***18600204d Moscow SVETOTEKHNIKA in Russian  
No 4, Apr 89 pp 14-15*

[Article by S. I. Mayzenberg, engineer, Special Manufacturing Engineering Office of Lighting and Light Signalization Equipment]

[Abstract] The two interrelated basic reliability criteria for airfield takeoff-and-landing runway lights are, in accordance with ICAO standards, that not more than 5 pct of all lights in one group are out of order and that not more than two adjacent lights are out of order. Segregation of all lights in a group into two interleaving subgroups is proposed, each

subgroup being connected through a separate cable to its isolation transformer so that no two adjacent lights are connected to the same source and symmetry is retained even with one entire subgroup out of order. Two additional reliability criteria are appropriate for scheme "a" with lights spaced 30 m apart and scheme "a/2" with lights spaced 15 m apart, a relaxing criterion which allows failure of an entire subgroup and one recognizing that failure of  $m$  lights in clusters of up to three in the "a/2" scheme is equivalent to failure of  $m/3$  lights in the "a" scheme. The probability of failure-free operation can accordingly be estimated in four ways, namely by applying either only the two basic criteria or all four criteria to lights connected individually and to lights connected groupwise. The four algorithms are demonstrated on a group of 24 lights, the probabilities ranging from 0.9802 (only basic two criteria applied to group connection) to 0.9999 (all four criteria applied to individual connection). Figures 2.

UDC 621.327.534.15:658.567.1

#### Facilities for Salvaging Discharge Lamps

18600204e Moscow SVETOTEKHNIKA in Russian  
No 4, Apr 89 p 21

[Article by S. A. Klyuyev, candidate of technical sciences, All-Union Scientific Research and Design Institute of Heavy Electrical Industry]

[Abstract] An essential problem in construction of facilities for salvaging discharge lamps by their demercurization is to ensure that environmental protection standards be satisfied. Preference should be given to UDL-60/100/150/750 demercurizers capable of reprocessing respectively 60, 100, 150, 750 lamps in one hour (300, 500, 750, 3500 thousand lamps annually) and also capable of salvaging the burners of DRL, DRI, DRIZ, DNAT lamps. Necessary technical specifications can be obtained from the All-Union Scientific Research Institute of Raw Materials Conservation in Mytishchi (Moscow Oblast). On account of the health hazards, a survey of users will indicate whether lamp salvage facilities should be installed in individual plants or in one plant for a group of enterprises or in one plant for the entire city. Such a plant for Moscow, with a capacity of 3.5 million lamps annually, is scheduled to be built in 1989-90.

UDC 621.375.826.006

#### Use of Lasers in Show Houses

18600204f Moscow SVETOTEKHNIKA in Russian  
No 4, Apr 89 pp 21-22

[Article by G. I. Ashkenazi, engineer, chairman of Illumination Engineering Section, Moscow Subgroup, MP VNTOE (not further identified)]

[Abstract] A special All-Union Standard 43-12.2.001-86 concerning use of lasers in theaters has been approved by the USSR Ministries of Culture and Public Health as well as by the Professional Union of Workers in the

Cultural Sector, its purpose being to ensure protection against harmful uncontrollable laser radiation. This standard went into effect on 1 January 1988, but has since been found to require amendments calling for mandatory measurement of laser radiation and monitoring of the radiation dose. The standard allows only professional light effect specialists and nobody else to operate lasers in closed or open spaces, for artistic performances only, not in any other public places including schools and day care centers. Photomusic is one such application for lasers, outlined and analyzed with recommendations in the book "Photomusical Instruments" by B. M. Galeyev, B. M. Zorin, and R. F. Sayfullin.

#### Human Therapeutic UV Irradiation

18600238a Moscow SVETOTEKHNIKA in Russian  
No 5, May 89, pp 1-5)

[Article by no author]

[Abstract] This article is the official text for instructions on the procedures for implementing human therapeutic UV irradiation. The instructions specify the hygiene conditions on the exposure areas and discuss the techniques for monitoring UV irradiation levels and the maintenance of safe ultraviolet dosages. The procedures for personnel protection from irradiation, terms and definitions and equipment recommended for therapeutic UV irradiation are all discussed. The specific ultraviolet radiation dosages are outlined for given age groups, with the duration, units or irradiation, and exposure levels specified in detail.

#### The "Pulsar" Pulse Spectrocolorimeter

18600238b Moscow SVETOTEKHNIKA in Russian  
No 5, May 89, pp 8-11

[Article by V. A. Solovyev, V. P. Shabalov]

[Abstract] This article analyzes the "Pulsar" pulse spectrocolorimeter which is designed to measure the chrominance of nonself-illuminated objects. It contains a pulse parallel spectrophotometer configured as a polychromator using interference light filters. Any of three photometric modules can be connected to the spectrophotometer module through an optoelectronic connector. A d/8 fixed sensor with a d/8 measurement geometry and an artificial pulse source; a 45/0 fixed sensor with a 45/0 measurement geometry and a portable sensor which employs a d/8 measurement geometry. The article provides figures showing the overall view of the system as well as that of its component parts. A block diagram of the spectrocolorimeter with the d/8 fixed sensor is provided. The "Pulsar" spectrocolorimeter has an integrated design which allows further expansion of the functional capabilities of the device as new photometric modules are developed.

### **The Special Characteristics of Vision Performance in Video Display Terminal Work**

18600238c Moscow SVETOTEKHNIKA in Russian  
No 5, May 89, pp 12-14

[Article by V. G. Martirosova, S. G. Tereshkevich, M. A. Faermark]

[Abstract] This article considers the consequences to human vision of a visual response from long-term exposure to video display terminals. Some of the common complaints of video display workers are categorized and classified in terms of length of exposure, type of fatigue, type of symptom and effect on productivity. The article also discusses five aspects of lighting work stations and work environments where video display terminals are used. These analyses indicate that the visual performance of video display terminal users as well as the objects of observation are highly specific in nature. A brief analysis of visual performance as well as the nature of disruptions to such performance resulting from video display terminal use suggest that excellent lighting is required to achieve any improvement in the very severe working conditions in which the users operate. The article concludes that standard illumination techniques are clearly insufficient for such applications.

### **Performance Analysis of Krypton Lamp Designs**

18600238d Moscow SVETOTEKHNIKA in Russian  
No 5, May 89, pp 17-18

[Article by A. F. Zotov]

[Abstract] This article derives some simple calculation relations that relate the luminous output, service life, and power of incandescent lamps to the composition of the krypton material. These relations can be used to calculate the effectiveness of krypton media in both general and special purpose incandescent lamps and to determine possible enhancement of various lighting parameters while diminishing the power consumption of the lamps.

### **Analysis of the Thermal Resistance of Protective Luminaire Glass**

18600238e Moscow SVETOTEKHNIKA in Russian  
No 5, May 89, p 18

[Article by L. Ye. Belousova]

[Abstract] This article proposes a simple method of determining a thermal resistance criterion for glass using a thin circular wafer under fixed heating as a prototype. This type of heating corresponds to the operating conditions of glass in the majority of lighting systems. Equations are derived for the thermal resistance criterion as the difference of the average surface temperature and the edge temperature of the prototype at the breakdown point. The radial temperature distribution is measured and the safety factor for glass strength is calculated in a subsequent analysis. The proposed method is used for

comparative evaluations of the thermal resistance of glasses of various composition.

### **The Artificial Lighting Laboratory of the Scientific Research Institute of Construction Physics**

18600238f Moscow SVETOTEKHNIKA in Russian  
No 5, May 89, pp 26-27

[Article by V. Ye. Bolyenok]

[Abstract] This article is devoted to the founding, establishment and growth of the artificial lighting laboratory at the Scientific Research Institute of Construction Physics, as well as the primary fields of research at present and future areas of interest. The laboratory staff has varied in size from 16 to 20 over the years. The primary mission of the laboratory is to provide necessary services to the construction industry as the laboratory is under the USSR State Committee on Construction. The primary areas of research interest at the laboratory include illumination engineering and standardization of artificial lighting. This includes the development and approval of All-Union documents on lighting design for construction and remodeling of buildings, structures, and other facilities, while illumination engineering includes research and development of lighting techniques using traditional methods and lighting equipment as well as promising nontraditional methods. Laboratory research is used in artificial lighting of museums, galleries, exhibition halls, and other facilities.

### **Application of Compensators in Tomographic Analysis of Composites**

18600249a Sverdlovsk DEFEKTOSKOPIYA in Russian  
No 6, Jun 89, pp 8-12

[Article by V. I. Barakhov, V. A. Chernyaeva, A. P. Stepanov, V. S. Kiselev]

[Abstract] This article discusses the role of structural imperfections and irregularities, micro- and macro-defects in causing irregularities in the initial operational properties of composites. Such defects arise in the industrial fabrication process and the need to account for the nature of such defects as well as the mechanisms behind their appearance, development and effect on the strength, stress, transport, and other properties of the composites makes it necessary to use compensators to analyze the internal structure of the composites via X-ray computer tomography. The article carries out experiments employing a calcium chloride solution as a compensator for the composites when used in a X-ray computer tomography. Test results are given for the case where the calcium chloride compensator solution is both used and excluded from the composites and such factors as the linear coefficient of attenuation and variations in organic plastic density are calculated. Techniques for calculating an optimum solution concentration are discussed together with the importance of determining the layer thickness

UDC 535.241.13:534

### Video Filter on Paratellurite Crystal

18600211a Moscow VESTNIK MOSKOVSKOGO  
UNIVERSITETA, SERIYA 3: FIZIKA,  
ASTRONOMIYA in Russian Vol 30 No 2, Mar-Apr 89  
(manuscript received 8 Jan 88) pp 41-45

[Article by V. B. Voloshinov, O. V. Mironov, and V. N. Parygin, Department of Oscillation Physics]

[Abstract] The feasibility of spectral filtration of an intermediate-infrared (2000-4000 nm) image with a uniaxial para- $\text{TeO}_2$  single crystal of the tetragonal 422 class is established theoretically, the principle of such a tunable acoustooptic filter with a wide aperture for the light beam being based on noncollinear anisotropic diffraction of the light beam by an ultrasonic wave when the optical axis of the crystal lies in the (100) plane of acoustooptic interaction at some angle  $\alpha$  to the sound wave vector. This angle determines the necessary configuration of the acoustooptic cell, including orientation of the sound wave vector relative to the light wave vector characterized by incidence angle  $\theta$ . Angle  $\theta$  depends on the frequency of the ultrasound and in turn determines the optimum angle  $\alpha$ . Calculations made for light of 3390 nm wavelength from a He-Ne laser and ultrasound of 39.4 MHz frequency, taking into account diffractive divergence of a sound wave, yield an optimum  $\alpha$  angle of 18.9 deg. The corresponding optimum  $\theta$  angle is 38.1 deg, a small change of the ultrasound frequency from the nominal one causing a large deviation of angle  $\theta$  from the optimum one. The acoustooptic cell can be designed on this basis with an angular aperture as wide as 45 deg and can be further optimized by beveling the crystal so as to minimize deflection of the light beam leaving the cell. Figures 4; references 8: 6 Russian, 2 Western.

UDC 621.385.6

### Numerical Analysis of Nonsteady Systems With Virtual Cathode

18600211b Moscow VESTNIK MOSKOVSKOGO  
UNIVERSITETA, SERIYA 3: FIZIKA,  
ASTRONOMIYA in Russian Vol 30 No 2, Mar-Apr 89  
(manuscript received 27 Jan 88) pp 46-49

[Article by A. D. Poyezd, A. G. Sveshnikov, and S. A. Yakunin, Department of Mathematics]

[Abstract] Injection of a tubular relativistic electron beam into a coaxial cylindrical waveguide is considered, the electron beam generating a strong electromagnetic field which tends to retard it and carrying a current higher than critical in vacuum so that a virtual cathode forms near the entrance where the energy of the electrostatic field exceeds the energy of electrons which will be reflected. Electrons with higher energy will be instantaneously absorbed by the cap closing the other end of the inner waveguide cylinder. Numerical analysis of the

transient processes in such a system is based on the self-consistent system of three equations of electrodynamics: for curl  $E$ , for curl  $B$ , and for the electron distribution  $f(t, r, p)$  as a function of time  $t$ , radial coordinate  $r$ , and electron momentum  $p$ . The electron beam is assumed to be a monoenergetic one with a steep front and conventional boundary conditions are stipulated for the electromagnetic field at the surface of a metal cylinder, only TM modes being excited owing to axial symmetry of the system and only drift waves leaving the waveguide through the open end between the two cylinders. The results of calculations using conservative finite-difference schemes indicate that the efficiency of energy transfer from such an electron beam to the electromagnetic field decreases slowly while the amount of energy transferred increases as the injection current is increased. Calculations were made for a 0.2 mm thick electron beam with an outside diameter of 1 cm carrying a current of 40 kA or 80 kA and a semiinfinitely long inner waveguide cylinder 2 cm in diameter with a 5 cm long outer waveguide cylinder 4 cm in diameter. Figures 4; references 7: 4 Russian, 3 Western.

### Select Performance Characteristics of a Fiber Ring Interferometer

18600226b Gorkiy IZVESTIYA VYSSHIKH  
UCHEBNYKH ZAVEDENIY: RADIOFIZIKA  
in Russian Vol 32 No 4, Apr 89, pp 426-435

[Article by I. A. Andronova, I. L. Bershteyn]

[Abstract] This study carries out a theoretical and experimental analysis of the effect of parasitic signals on the operation of a fiber ring interferometer as a gyrometer; these signals are the response of the laser to the back-scattered radiation as well as reflection and scattering by interferometer components and the fiber. The study examines possible techniques for eliminating such phenomena such as using frequency modulation or additional phase modulation to suppress parasitic signals. The study also discusses the ultimate sensitivity of a fiber ring interferometer that employs both coherent and noncoherent sources. The analysis itself considers five separate issues; these include the laser response to fiber ring interferometer radiation, the photocurrent responsible for the interference of the counterrunning waves from the fiber ring interferometer, the effect of parasitic waves from various irregularities in the optical fiber ring on the signal, the ultimate sensitivity of the overall system and specific experiments intended to test the physical mechanisms associated with these phenomena. The tests were carried out on an interferometer scheme containing 20 m of cylindrical fiber wound on a coil 18 cm in diameter. A phase modulator was placed at one end of the fiber; this modulator consisted of a circular piezoelectric washer 30 mm in diameter and 0.7 mm thick. The configuration made it possible to produce phase modulation of radiation in the fiber exceeding 2 rad at 60 kHz. A helium-neon laser producing one to three longitudinal modes was used as the radiation



source and an optical isolator was placed between the interferometer and the laser. This setup was used to test the proposals for using frequency modulation or additional phase modulation for parasitic signal compression and to analyze the effect of component scattering in the

fiber and the interferometer. The analysis reveals the optimum conditions for parasitic signal suppression and also confirms the theoretical conclusions. Certain methods of reducing the level of an interference signal are also discussed.

UDC 025.171

**Making Foreign-Language Scientific and Technical Information Available to Specialists in Control Devices and Systems**

*18600260c Moscow PRIBORY I SISTEMY  
UPRAVLENIYA in Russian No 4, Apr 89 pp 37-38*

[Article by G. G. Merkulov, candidate of education sciences, and G. Ye. Vinokurova, engineer]

[Abstract] Foreign-language scientific and technical information about latest developments and trends in instrument design and manufacture worldwide is made available to Soviet specialists in this field through the Central Specialized Reference-Information Fund in the Information Office for Measuring and Control Devices

at the Scientific Research Institute of information and Economics. Translations and to a larger extent abstracts of relevant books, journals, magazines, and catalogs are stored on microfilm. They are distributed to science and engineering libraries by interlibrary subscription. Copies are sent to management and service departments at the USSR Ministry of Instrumentation Industry. Most thorough information is extracted from catalogs of Allen Bradley (USA), Beckman (USA), Foxboro (USA), Hewlett-Packard (USA), IBM (USA), Motorola (USA), Perkin Elmer (USA), Kovo (Czechoslovakia), Tesla (Czechoslovakia), Danfoss (Denmark), Enertec (France), Telemecanique (France), Bosch (FRG), Hartmann Braun (FRG), Siemens (FRG), VEB Carl Zeiss (GDR), VEB Robotron (GDR), Isotimpex (Hungary), Metrimpex (Hungary), Olivetti (Italy), Canon (Japan), Hitachi (Japan), Electronum (Romania).

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